Submittal Package

Entrances | Storefronts | Window Walls | Curtain Walls | Balcony Doors | Sun Controls

Submitted to:

Project:

VA Outpatient Mental Health Building
Sioux Falls

Submitted by:

Heartland Glass Company
Timothy Bronsteader
June 27, 2019

YKK AP products Included:

YHC 300 OG, YFW 400 TUH

This submittal package is to assist in the specification and selection of YKK AP products. Basic product descriptions and technical data are included. For further information or technical assistance, please contact your local YKK AP representative.

visit our website at ykkap.com

YKK AP America's manufacturing facility located in Dublin, Georgia and has achieved ISO 14001 certification as a means to measure and continually improve environmental performance.

YHC 300 OG

YHC 300 OG

Impact Resistant and Blast Mitigating, Outside Glazed Curtain Wall

ProTek

ProTek®

YKK AP Hurricane & Blast Solutions

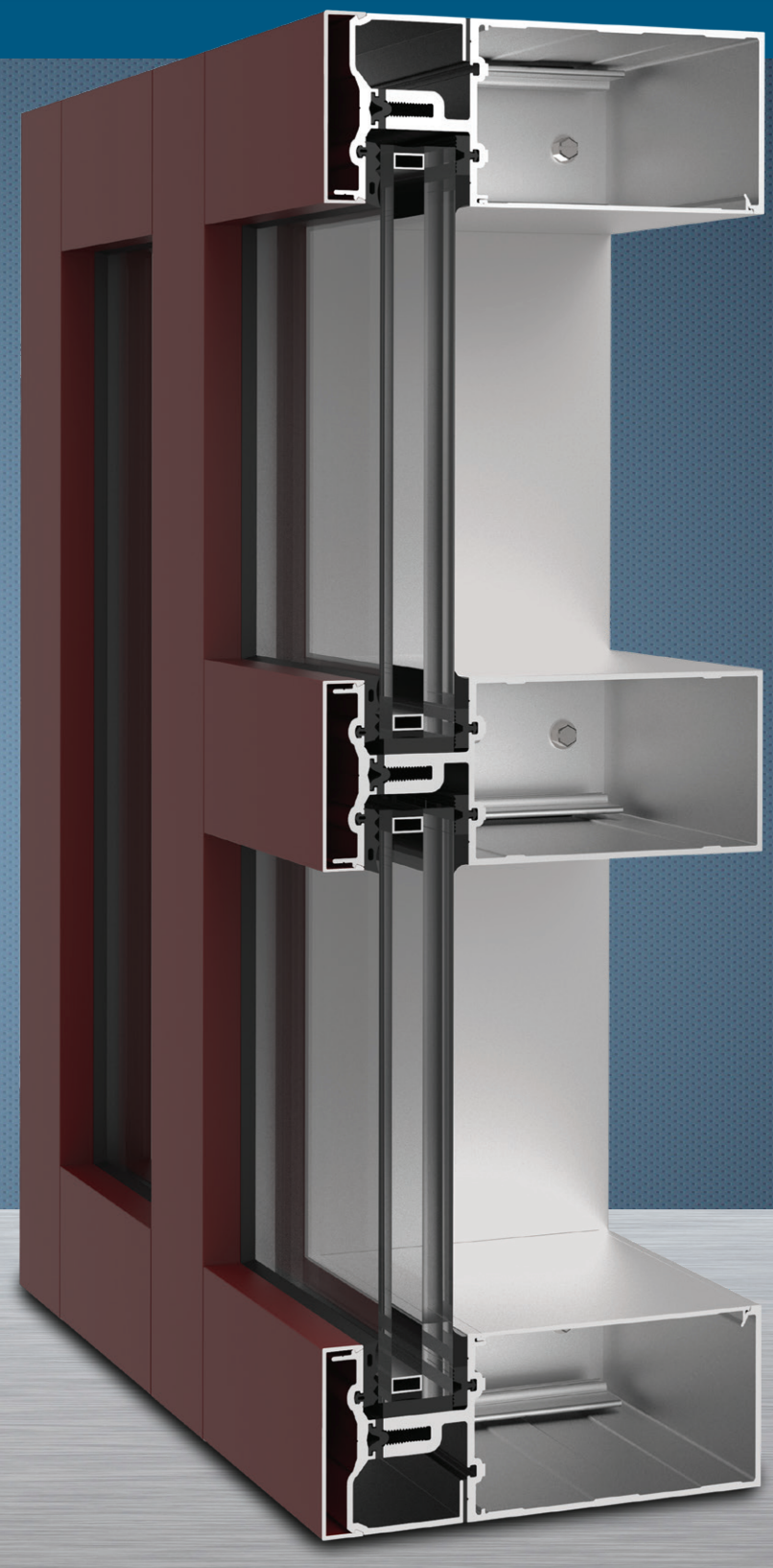
Protection for Every Application

The YHC 300 OG is a high performance curtain wall system designed and tested to provide innovative impact and blast solutions for a wide range of applications and design pressures from 45 PSF all the way to 130 PSF. The 3" face dimension ensures recommended glass clearances are maintained. Dry glazing options (for all design pressure ranges) slash installation time for quicker building dry-in. This data sheet also shows the PSF differences for each variation of the YHC 300 OG.

Product Options & Features

- Fully tested to ASTM 1886 / 1996 and TAS 201-203 standards
- Florida Product Approvals for large and small missile including HVHZ and Level E Protection
- Mullion options provide the most cost effective solutions across all pressures and designs
- 15/16" glass bites maintain GANA guidelines of 1/4" clearance to reduce glass breakage
- Designed for single and multispan applications
- Achieve 17' single spans at 90 PSF
- Accommodates monolithic and insulating glass
- Shallow mullion option available

YKK AP® Quality inspires®



YHC 300 OG

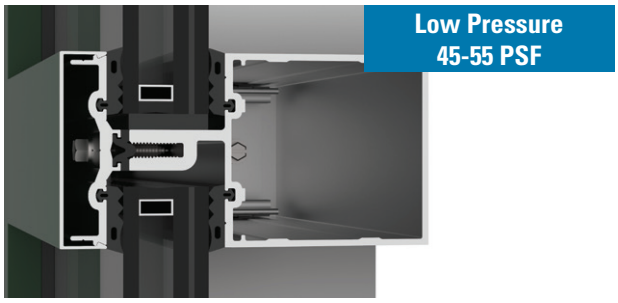
SYSTEM SPECIFICATIONS

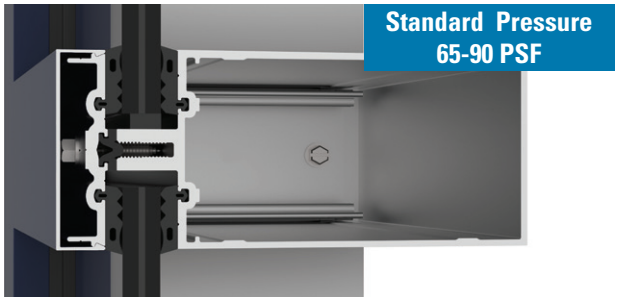
System Sightline	Base Depth	Glazing & Config	Glass	Air Infiltration	Water Infiltration	Thermal Performance	Acoustical Performance
3”	7-1/16”	Outside & Front Set	9/16” Monolithic or 1-5/16” IGU with Low-E (C.O.G. U-factor: 0.29)	0.06 CFM/FT² (1.10 m³/h·m²)	**Static:** 20 PSF (958 Pa) **Dynamic:** 20 PSF (958 Pa)	**U-factor:** 0.42 BTU/HR•FT²•ºF* **CRF:** Minimum of 72 on frame**	**Lam STC:** 37 **Lam OITC:** 32
Testing Standards				ASTM E 283	ASTM E 331 & AAMA 501	* NFRC 102 & ** AAMA 1503	ASTM E 90 & 1425
Product Approvals				Missile Level A, D, E, Wind Zone 3 & HVHZ, ICC Florida Building Code, TDI Compliant			
Available Finishes				Factory Anodized (AAMA 612) and Organic Paints (AAMA 2605)			

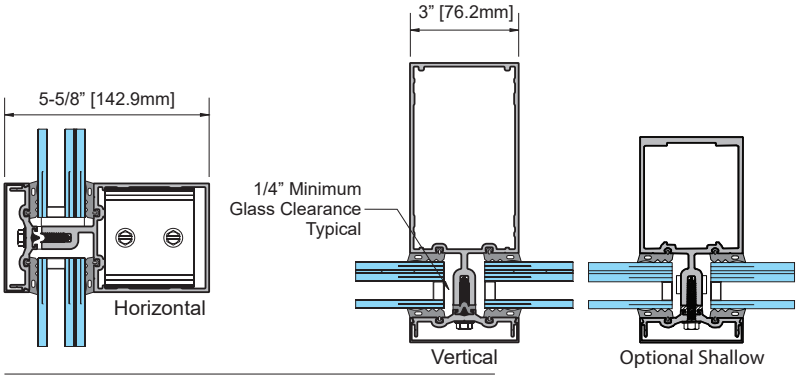
HURRICANE & BLAST PROTECTION

- ICC Compliant and FBC Statewide approvals – HVHZ (High Velocity Hurricane Zone)
- Large Missile Level E – Essential Facilities
- Large Missile Level D & Small Missile Level A
- “Low Hazard” per ASTM F 1642 Test @ 6 psi / 41 psi–ms

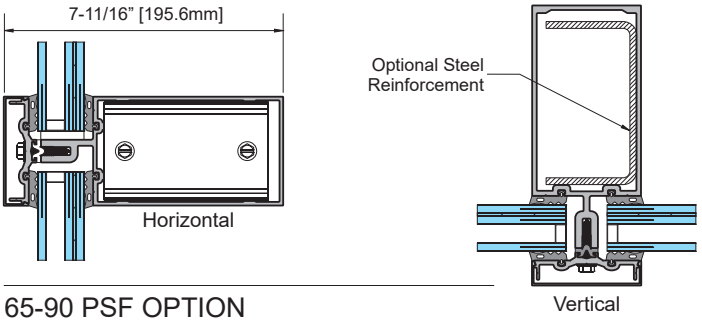
Dry Glazing option shown. Visit www.ykkap.com for glazing options and CSI Specs by performance and glazing type.



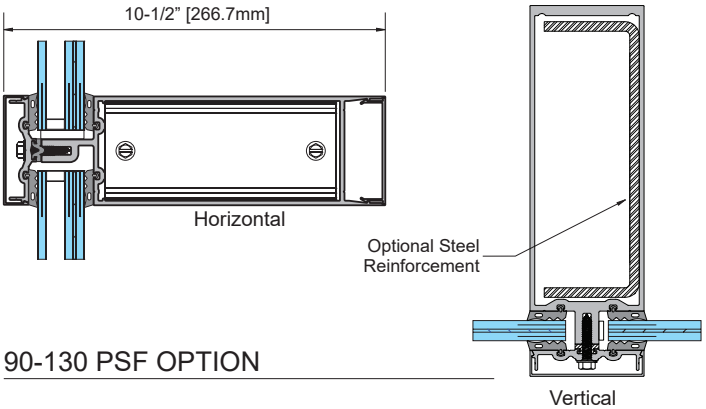




45-55 PSF OPTION



65-90 PSF OPTION

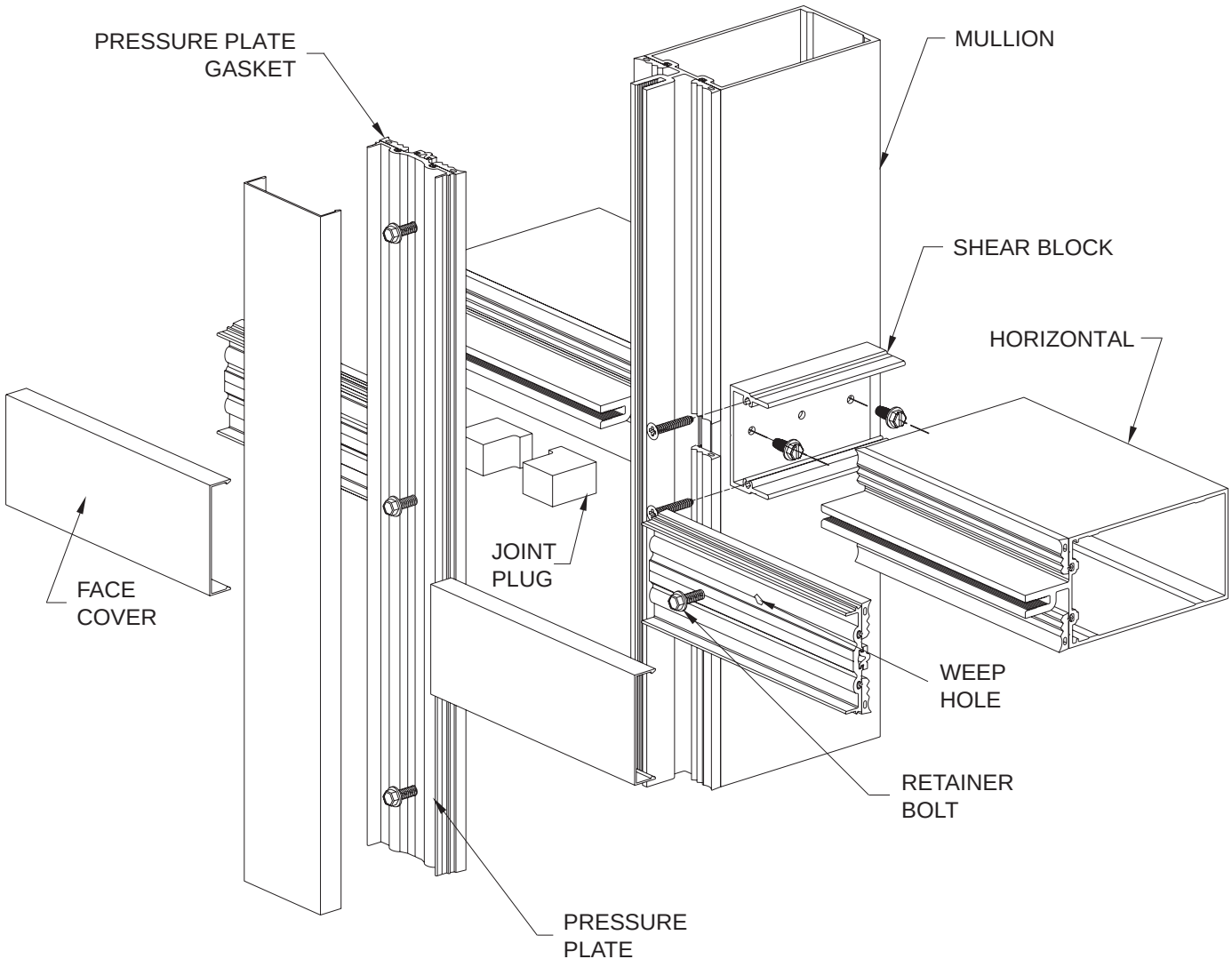


90-130 PSF OPTION

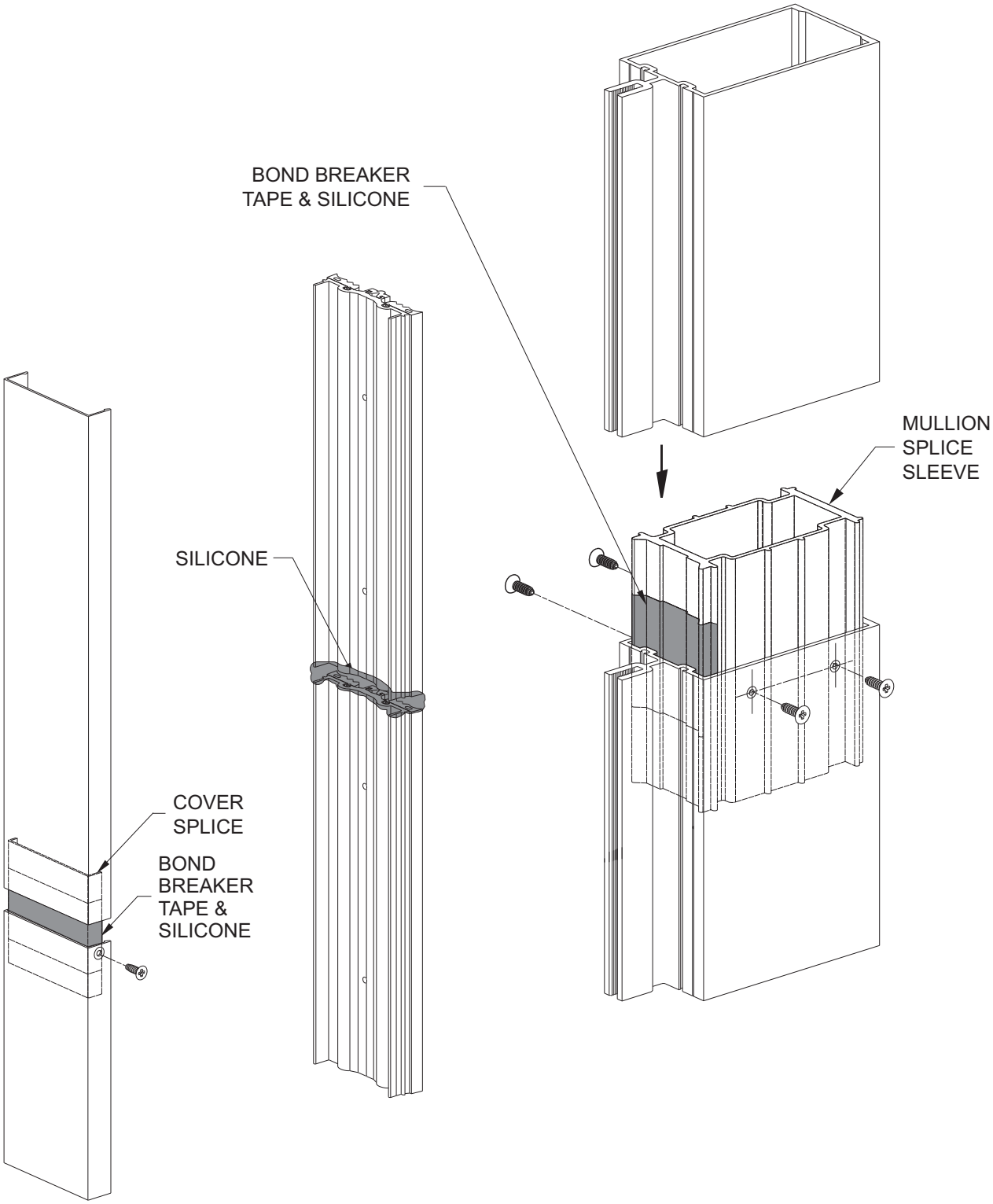
Additional information including CAD details, CSI specifications, Test Reports and Installation instructions are available online at:
www.ykkap.com/commercial/product/curtain-walls/yhc-300-og/

270 Riverside Pkwy, Suite 100, Austell, GA 30168 Tel: 678-838-6000

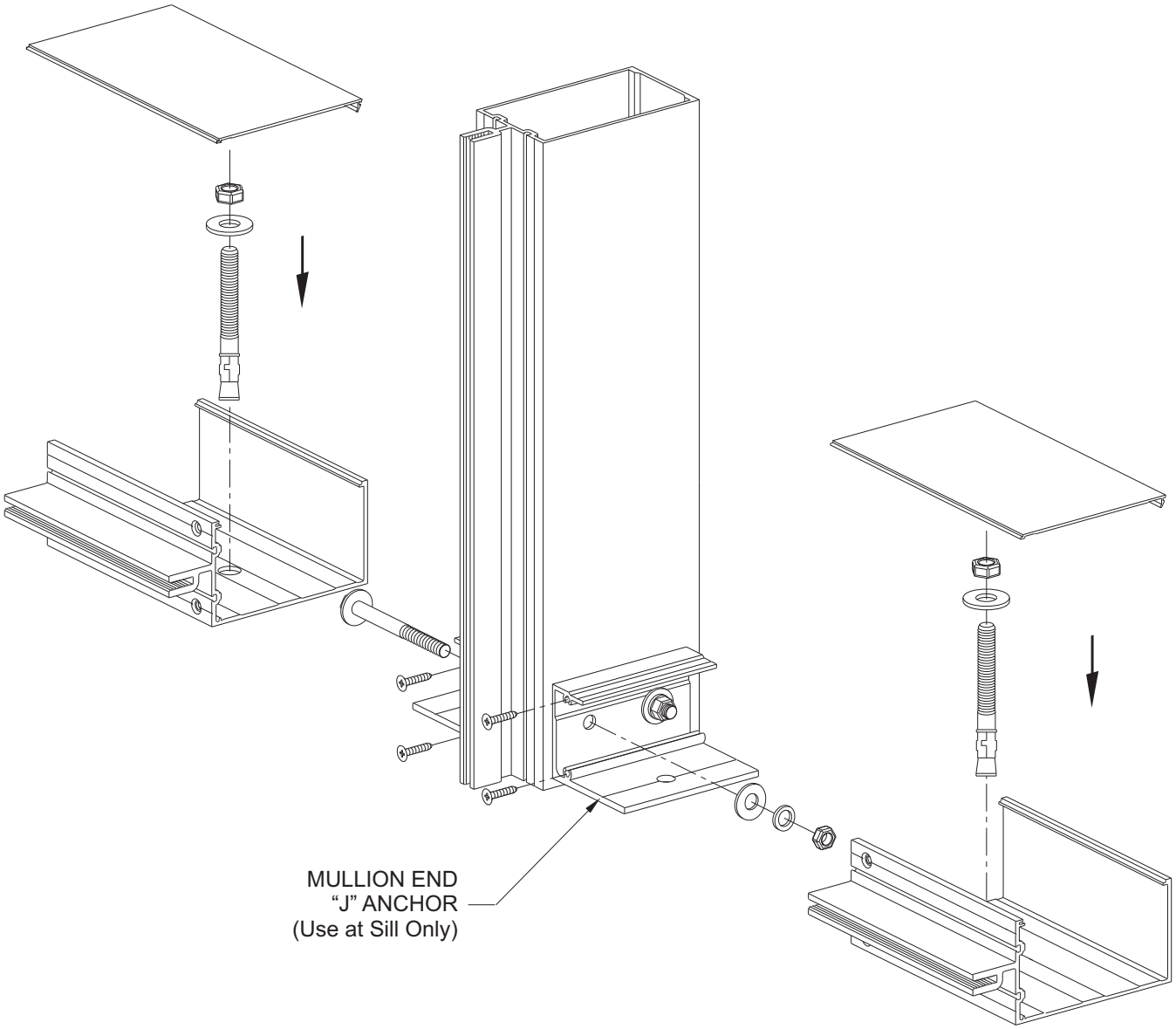
YHC 300 OG OUTSIDE GLAZED
HURRICANE RESISTANT CURTAIN WALL SYSTEM



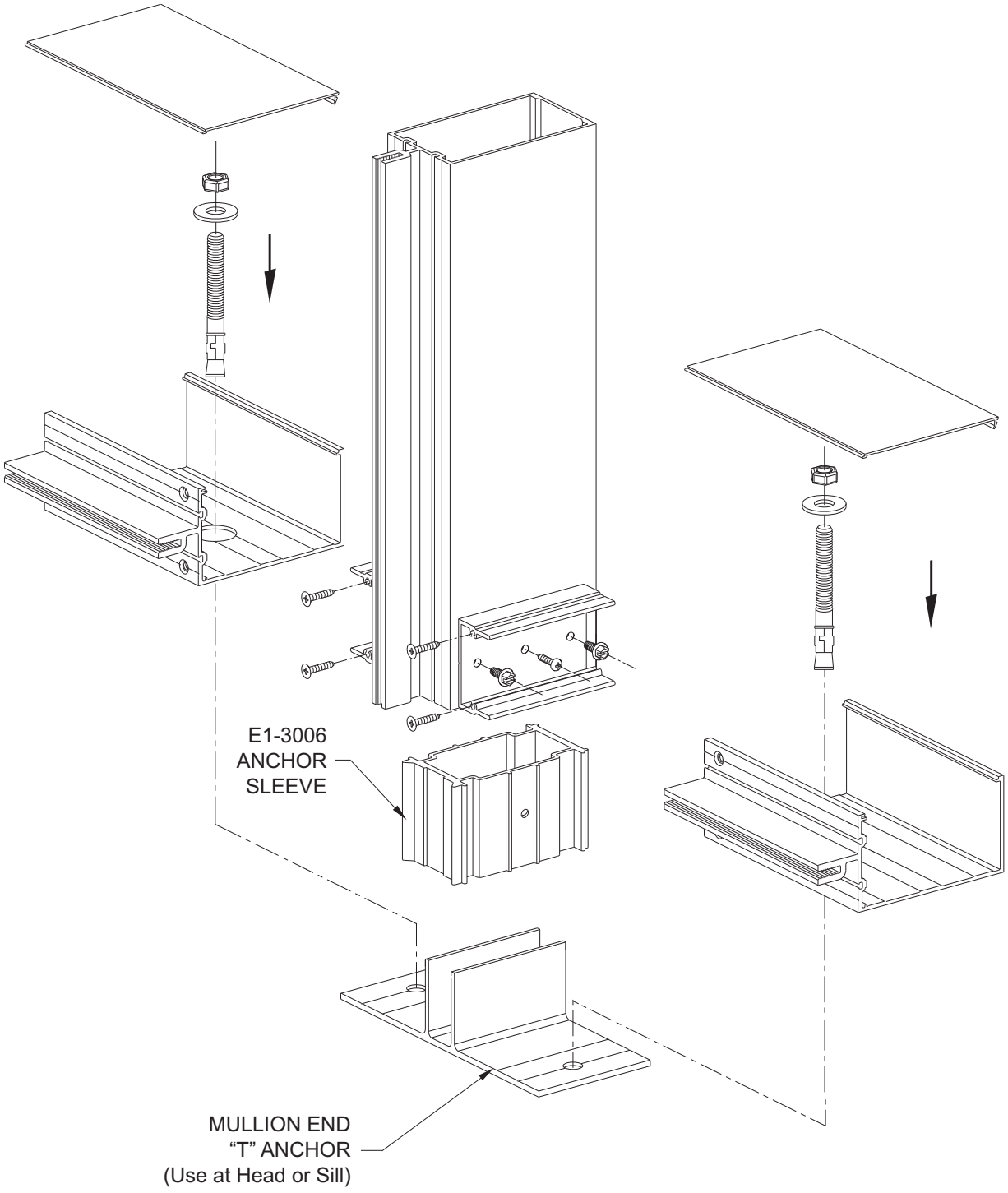
TYPICAL SPLICE CONDITION



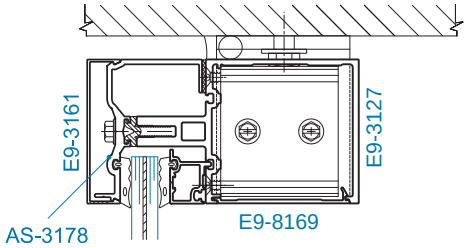
MULLION END “J” ANCHOR



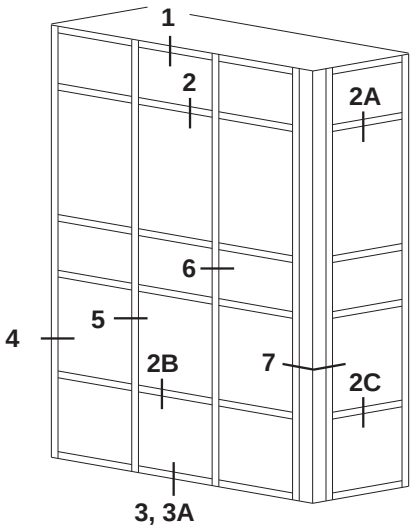
MULLION END “T” ANCHOR

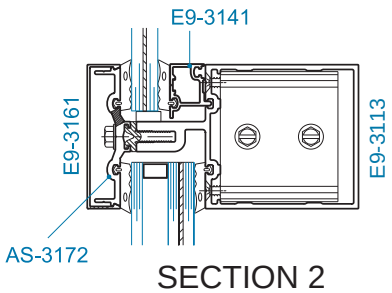


FOR DESIGN PRESSURES OF 45-55 PSF

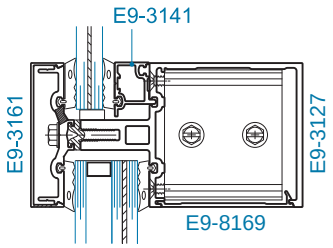


SECTION 1
HEAD w/ “T” or “F” Anchor

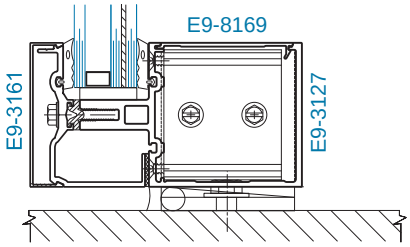




SECTION 2
HORIZONTAL (One Piece)
Mono. Gl. over Insul. Gl.



SECTION 2A
HORIZONTAL (Two-Piece)
Mono. Gl. over Insul. Gl.



SECTION 3
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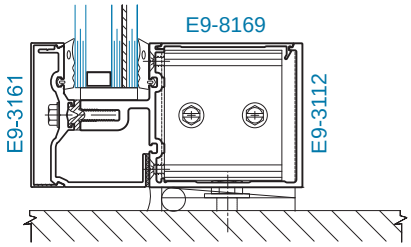
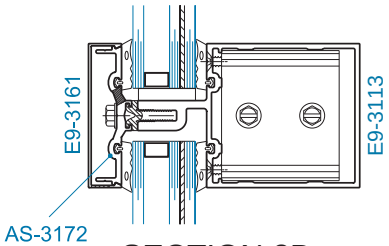
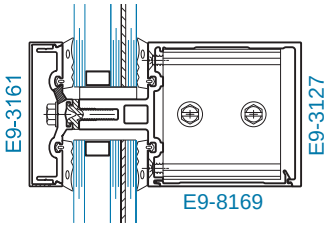


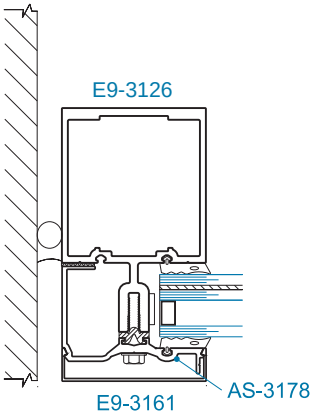
SECTION 3A
SILL w/ “T” or “F” Anchor



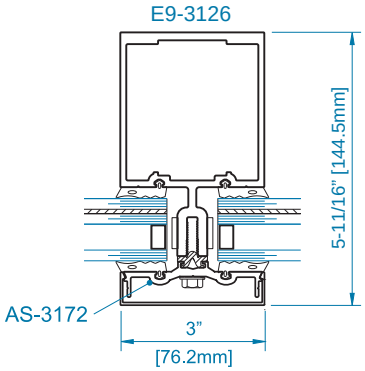
SECTION 2B
HORIZONTAL (One-Piece)
Insul. Gl. over Insul. Gl.



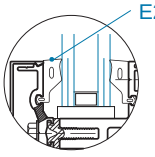
SECTION 2C
HORIZONTAL (Two-Piece)
Insul. Gl. over Insul. Gl.



SECTION 4
JAMB

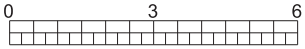


SECTION 5
MULLION



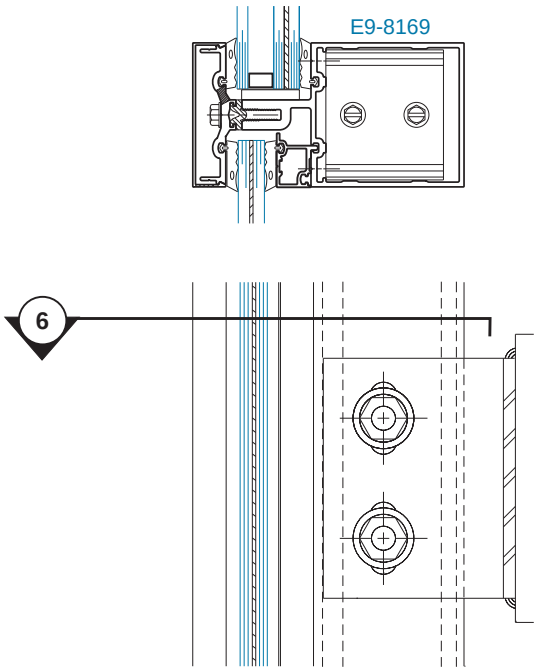
OPTIONAL 1” GLAZING
(For Non-Impact Conditions)

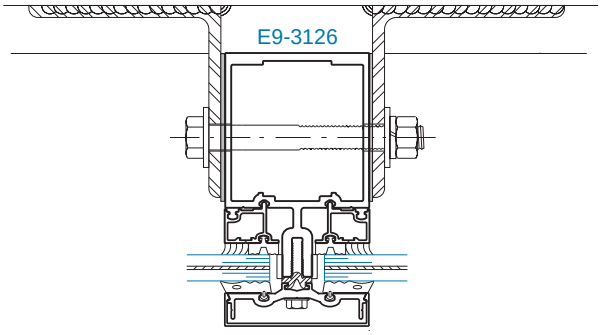
SCALE: 1/4 SIZE



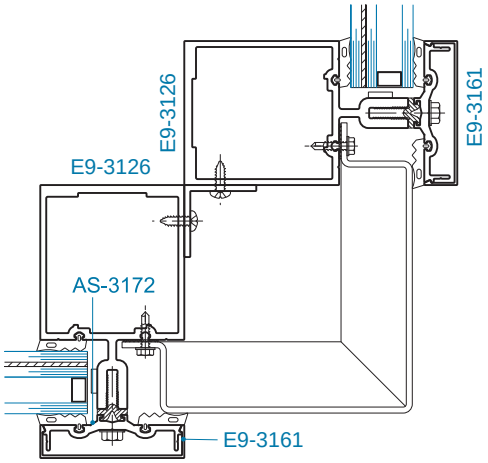
FOR DESIGN PRESSURES OF 45-55 PSF

TYPICAL WINDLOAD ANCHOR



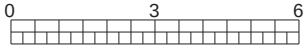


SECTION 6

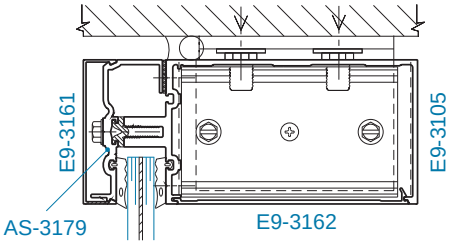


SECTION 7
90° OUTSIDE CORNER
SINGLE GLAZING

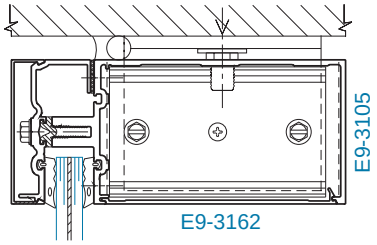
SCALE: 1/4 SIZE



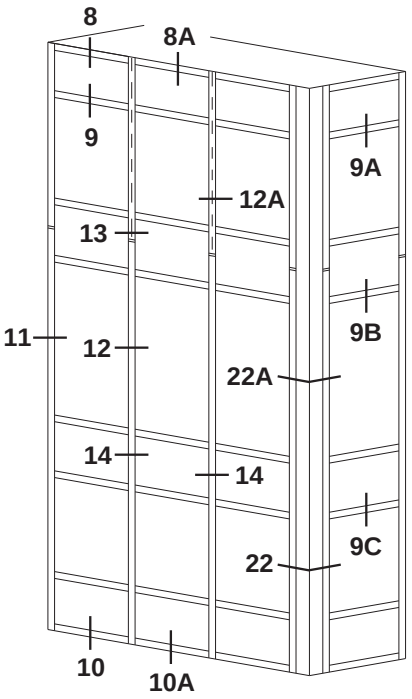
FOR DESIGN PRESSURES OF 45-55 PSF

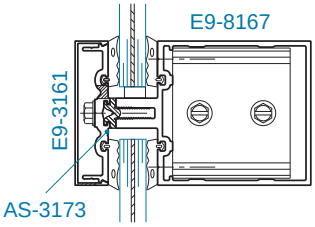


SECTION 8
HEAD w/ “F” Anchor

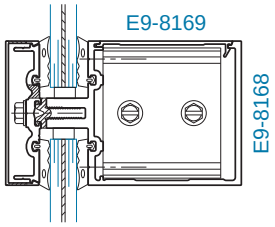


SECTION 8A
HEAD w/ “T” Anchor

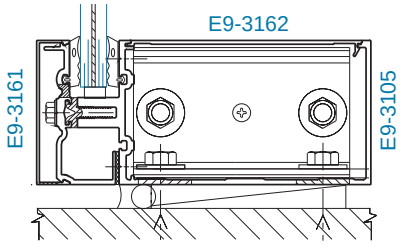




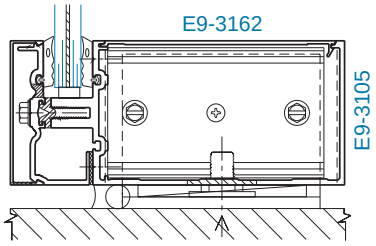
SECTION 9
HORIZONTAL (One Piece)



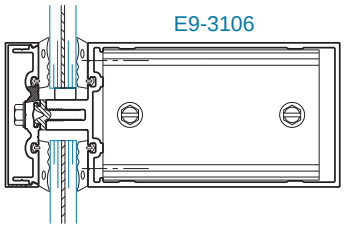
SECTION 9A
HORIZONTAL (Two-Piece)



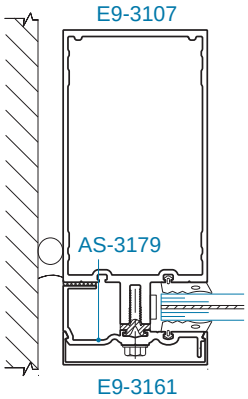
SECTION 10
SILL w/ “J” Anchor



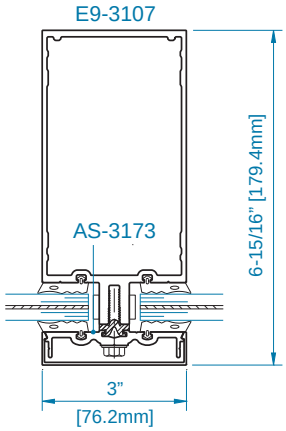
SECTION 10A
SILL w/ “T” Anchor



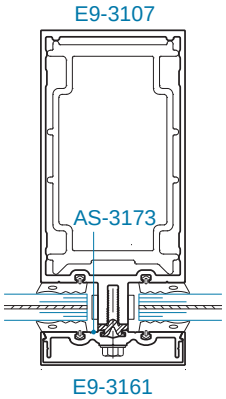
SECTION 9B
OPTIONAL HORIZONTAL
(One Piece)



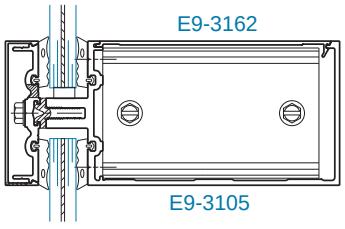
SECTION 11
JAMB



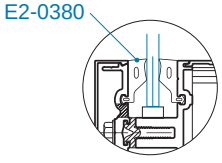
SECTION 12
MULLION



SECTION 12A
MULLION @ SPLICE

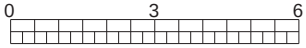


SECTION 9C
OPTIONAL HORIZONTAL
(Two-Piece)



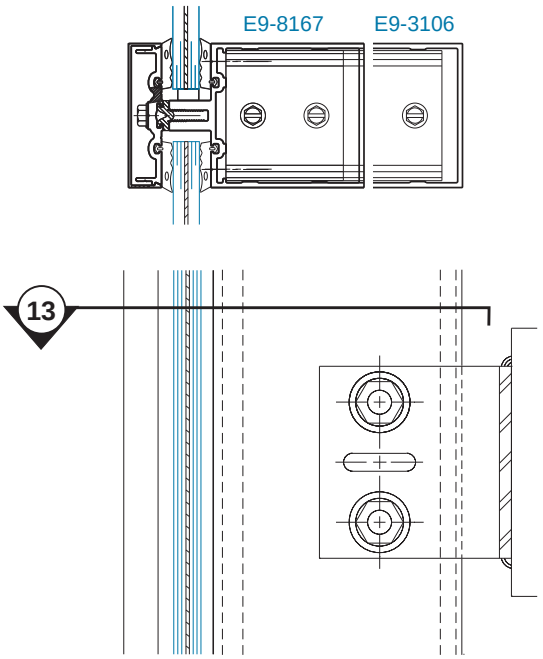
OPTIONAL 1/4” GLAZING
(For Non-Impact Conditions)

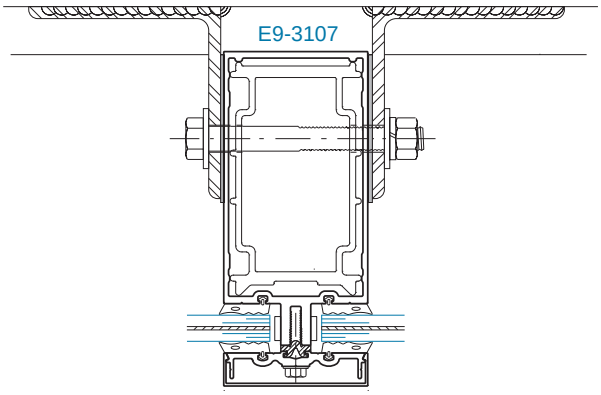
SCALE: 1/4 SIZE



FOR DESIGN PRESSURES OF 45-55 PSF

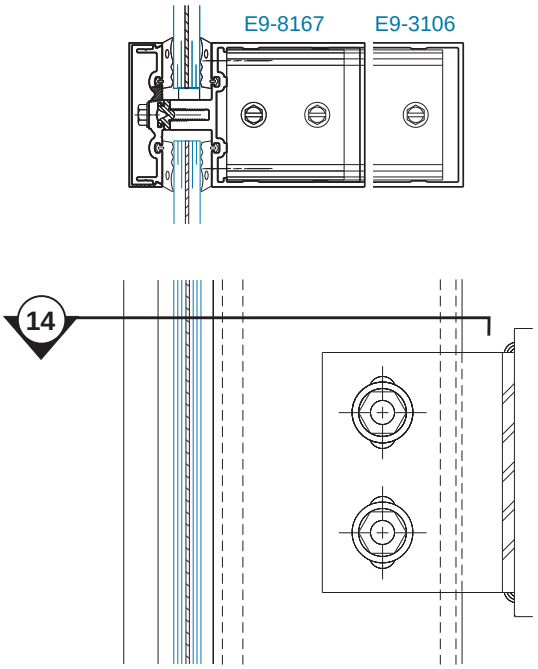
TYPICAL DEADLOAD ANCHOR

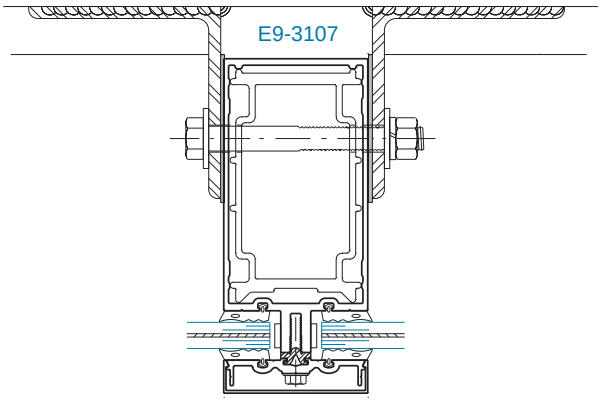




SECTION 13

TYPICAL WINDLOAD ANCHOR



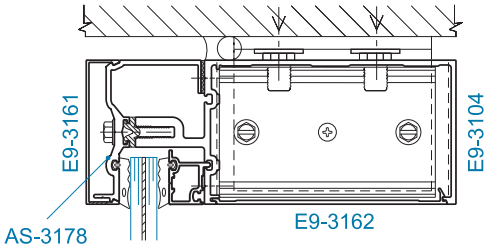


SECTION 14

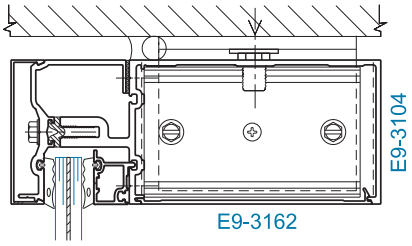
SCALE: 1/4 SIZE

0 3 6

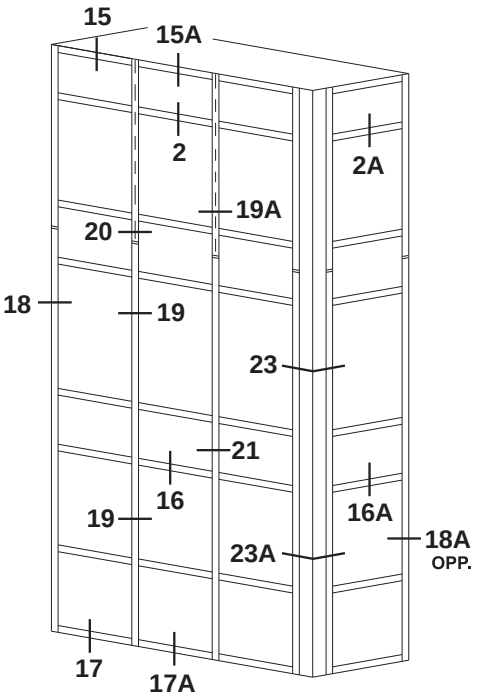
FOR DESIGN PRESSURES OF 45-55 PSF

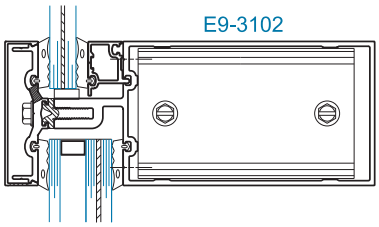


SECTION 15
HEAD w/ "F" Anchor

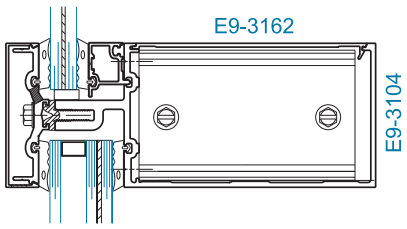


SECTION 15A
HEAD w/ "T" Anchor

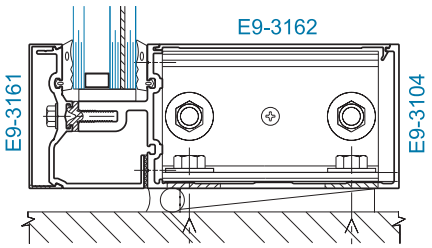




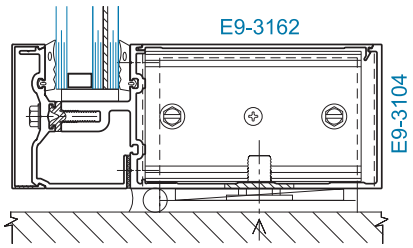
SECTION 16
OPTIONAL HORIZONTAL
(One Piece)



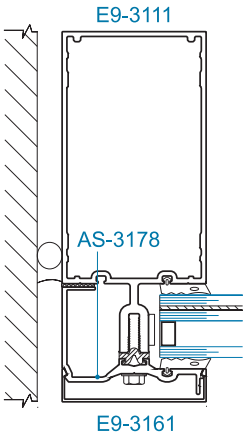
SECTION 16A
OPTIONAL HORIZONTAL



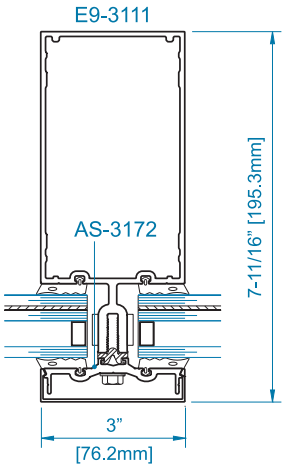
SECTION 17
SILL w/ "J" Anchor



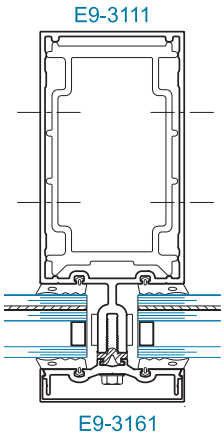
SECTION 17A
SILL w/ "T" Anchor



SECTION 18
JAMB

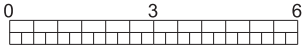


SECTION 19
MULLION

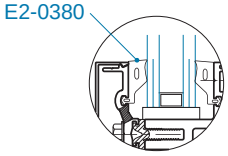


SECTION 19A
MULLION @ SPLICE

SCALE: 1/4 SIZE



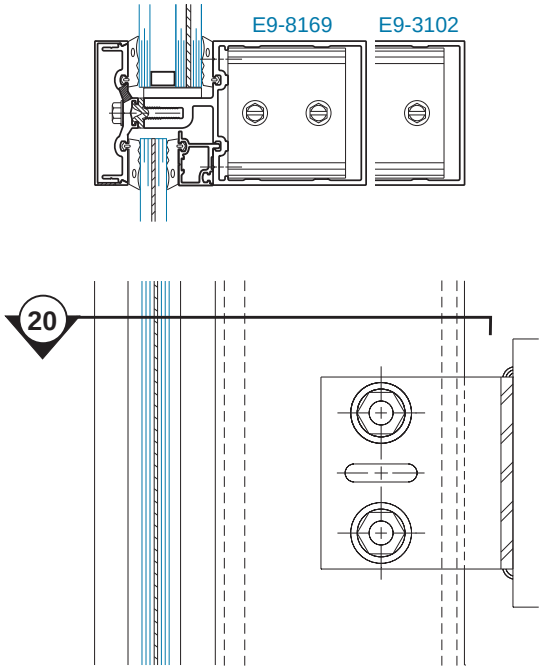
(Two-Piece)

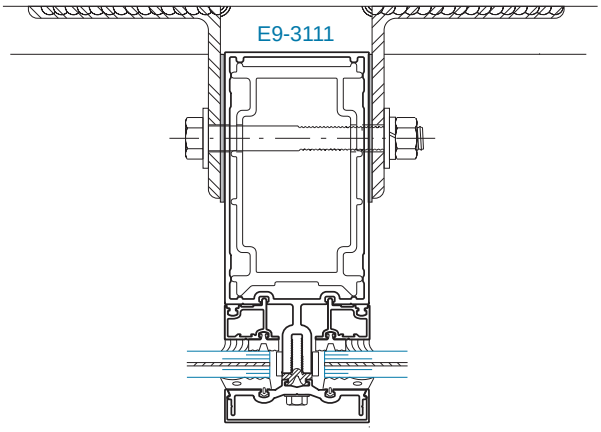


OPTIONAL 1" GLAZING
(For Non-Impact Conditions)

FOR DESIGN PRESSURES OF 45-55 PSF

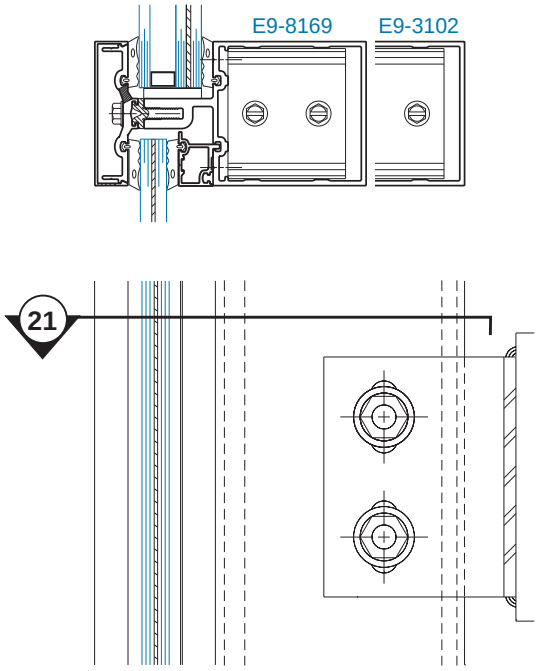
TYPICAL DEADLOAD ANCHOR

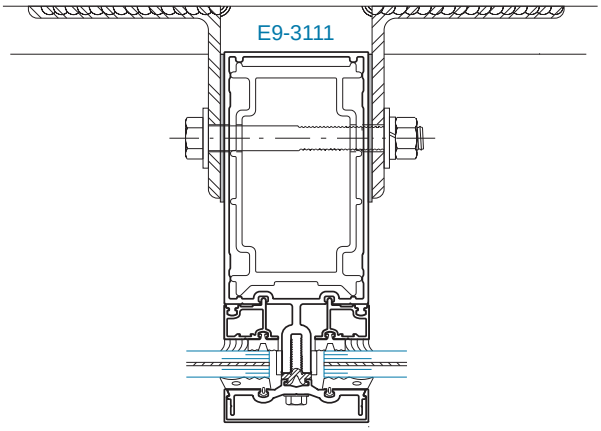




SECTION 20

TYPICAL WINDLOAD ANCHOR





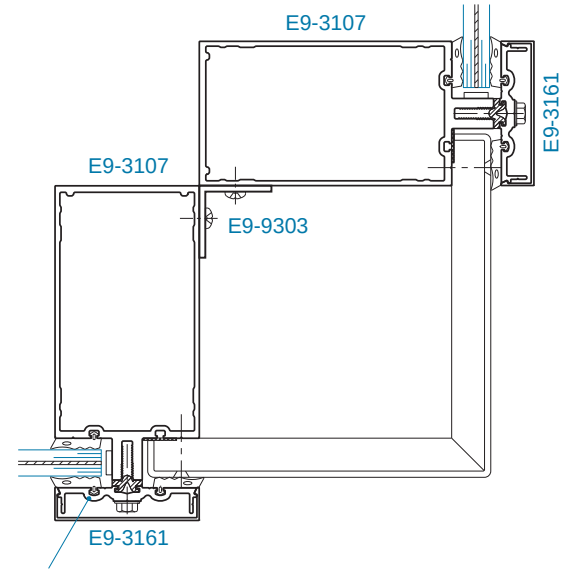
SECTION 21

SCALE: 1/4 SIZE

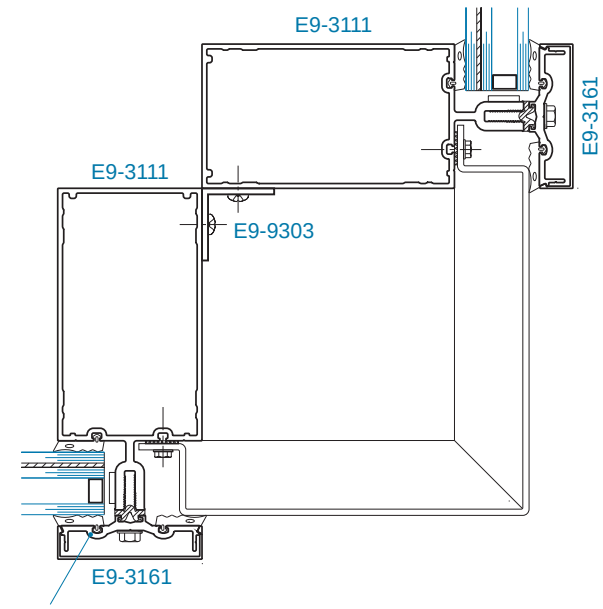
0 3 6

FOR DESIGN PRESSURES OF 45-55 PSF

STANDARD 90° CORNERS

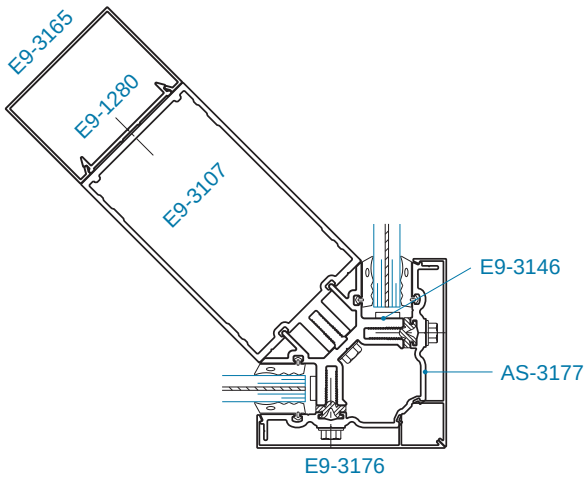


SECTION 22
90° OUTSIDE CORNER
SINGLE GLAZING

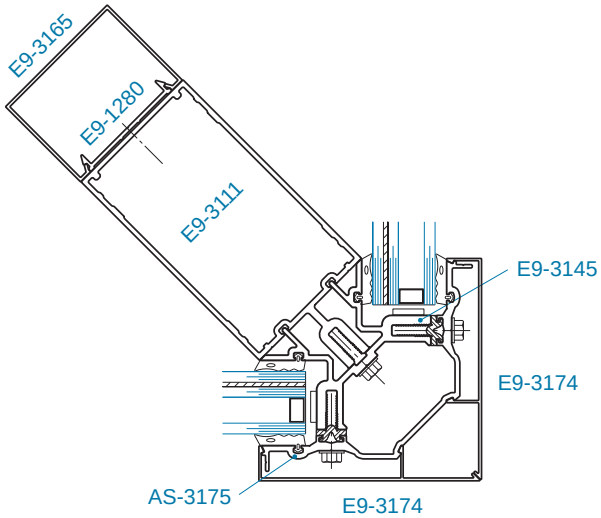


SECTION 23
90° OUTSIDE CORNER
INSULATING GLAZING

OPTIONAL 90° CORNER



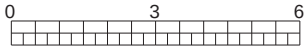
*SECTION 22A
90° OUTSIDE CORNER
SINGLE GLAZING



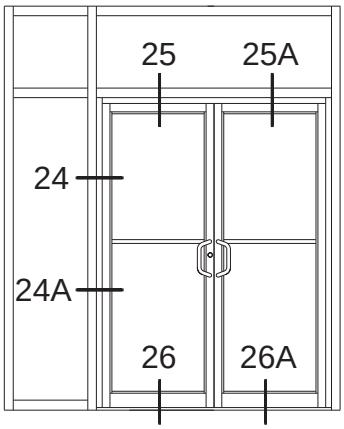
*SECTION 23A
90° OUTSIDE CORNER

***SECTION 22A & 23A - OPTIONAL 90° CORNERS SHOWN ABOVE, NOT CURRENTLY APPROVED IN FLORDIA**

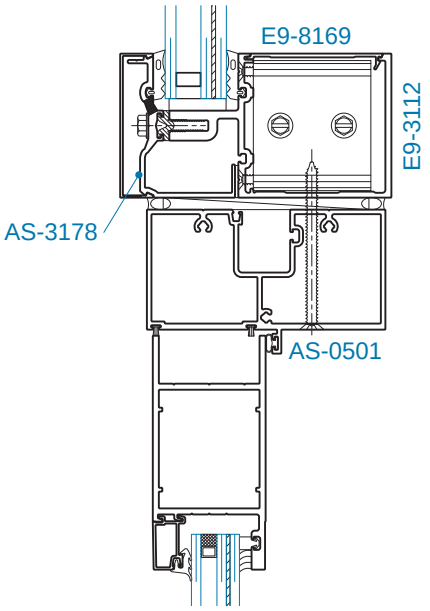
SCALE: 1/4 SIZE



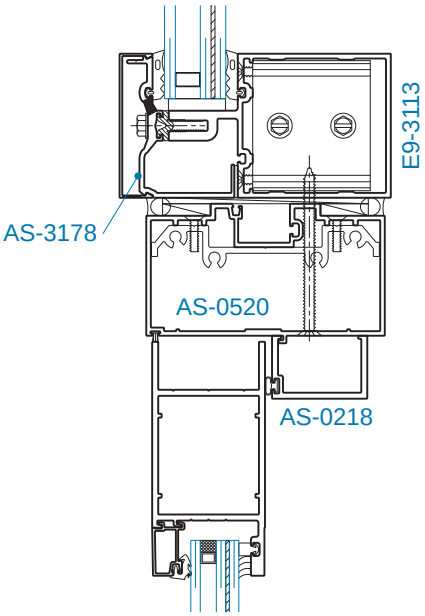
SHALLOW DOOR FRAMING MEMBERS WITH INSULATED GLAZING FOR DESIGN PRESSURES OF 45-55 PSF



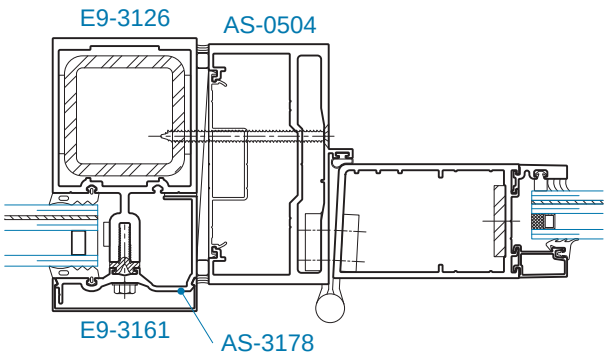
35H PAIR DOORS SHOWN



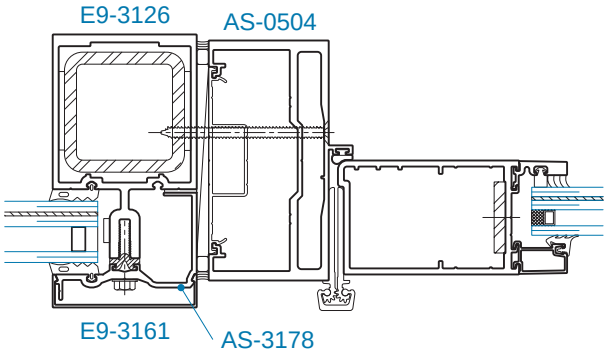
SECTION 25
STANDARD
TRANSOM BAR



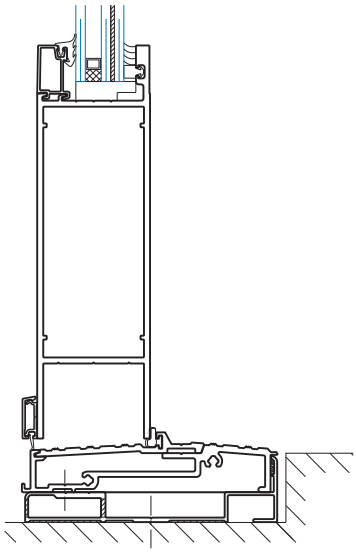
SECTION 25A
OHCC
TRANSOM BAR



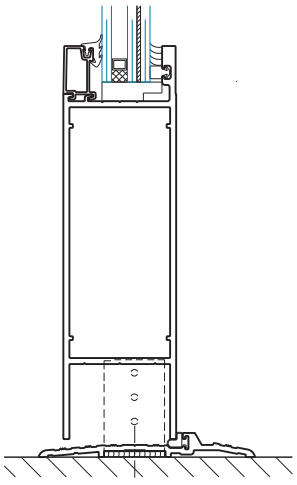
SECTION 24
DOOR JAMB
w/ BUTT HINGE



SECTION 24A
DOOR JAMB
w/ CONTINUOUS HINGE

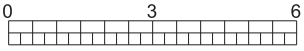


SECTION 26*
WATER RESISTANT
THRESHOLD



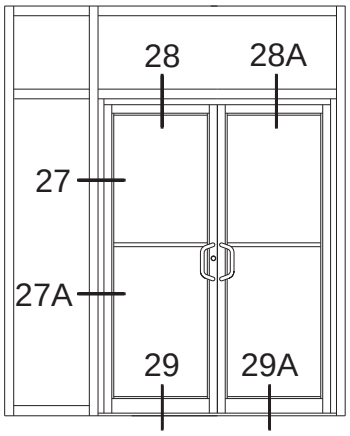
SECTION 26A**
AIR TIGHT THRESHOLD
**NOT APPROVED
FOR FLORIDA

SCALE: 1/4 SIZE

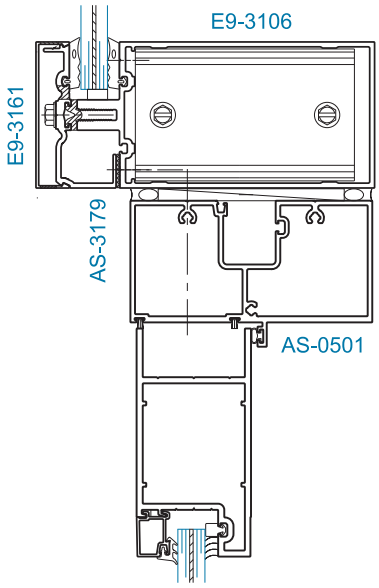


* Frames that employ the water resistant threshold, E9-0502, and are designated as ADA entrances, require a 1:12 slope ramp. For information contact YKK AP or ADA.

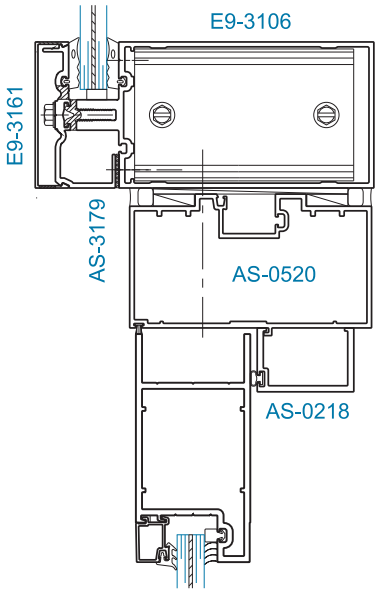
DOOR FRAMING MEMBERS WITH SINGLE GLAZING FOR DESIGN PRESSURES OF 45-55 PSF



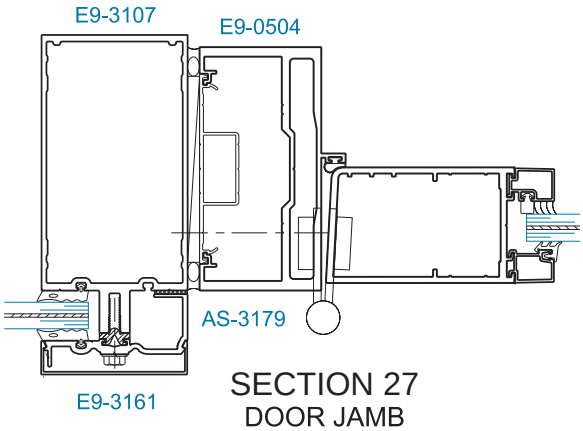
35H PAIR DOORS SHOWN



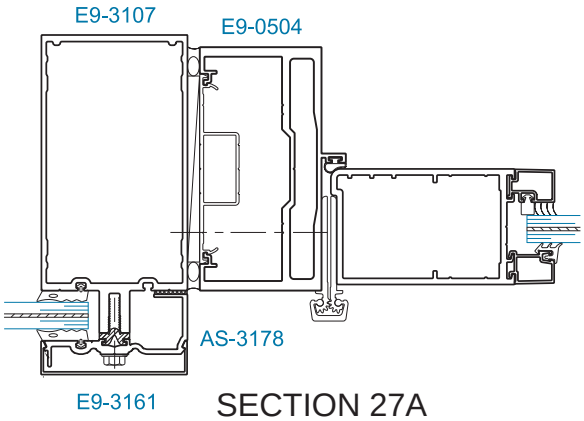
SECTION 28
STANDARD
TRANSOM BAR



SECTION 28A
OHCC
TRANSOM BAR

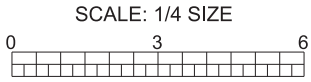


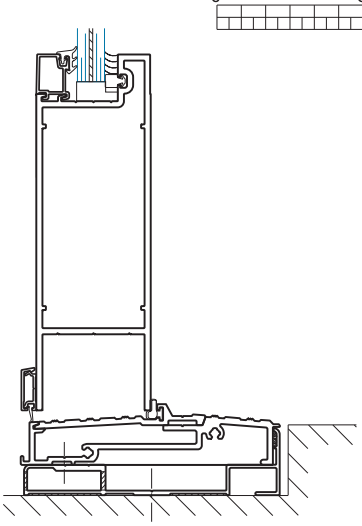
SECTION 27
DOOR JAMB
w/ BUTT HINGE



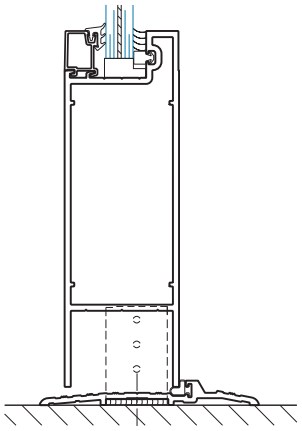
SECTION 27A
DOOR JAMB
w/ CONTINUOUS HINGE

SCALE: 1/4 SIZE





SECTION 29*
WATER RESISTANT
THRESHOLD

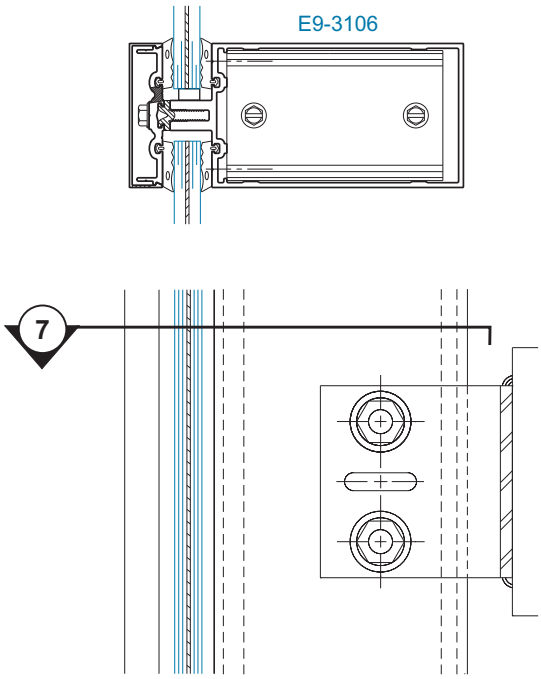


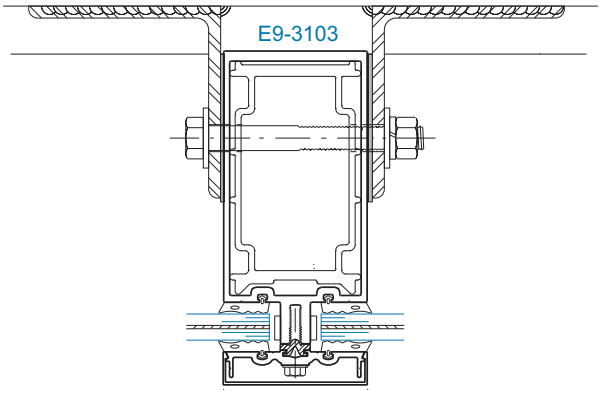
SECTION 29A**
AIR TIGHT THRESHOLD
**NOT APPROVED
FOR FLORIDA

* Frames that employ the water resistant threshold, E9-0502, and are designated as ADA entrances, require a 1:12 slope ramp. For information contact YKK AP or ADA.

FOR DESIGN PRESSURES OF 65-90 PSF

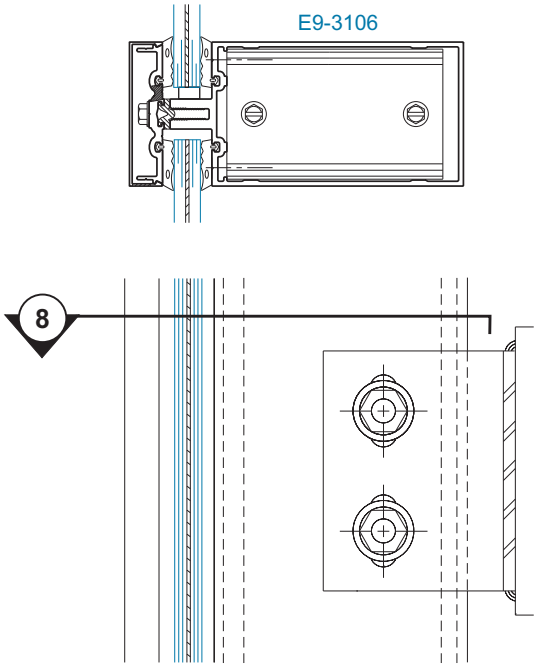
TYPICAL DEADLOAD ANCHOR

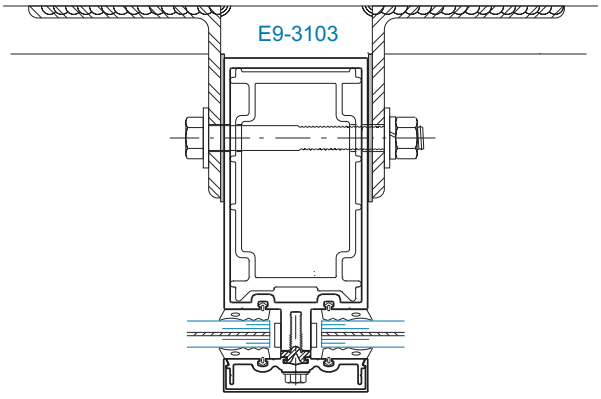




SECTION 7

TYPICAL WINDLOAD ANCHOR



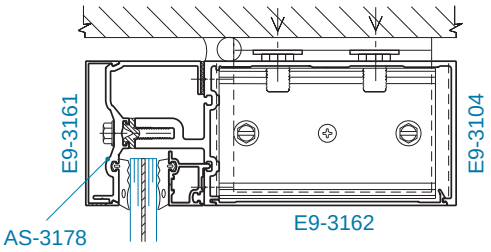


SECTION 8

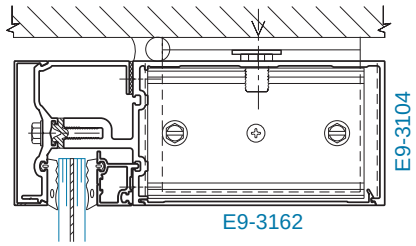
SCALE: 1/4 SIZE

0 3 6

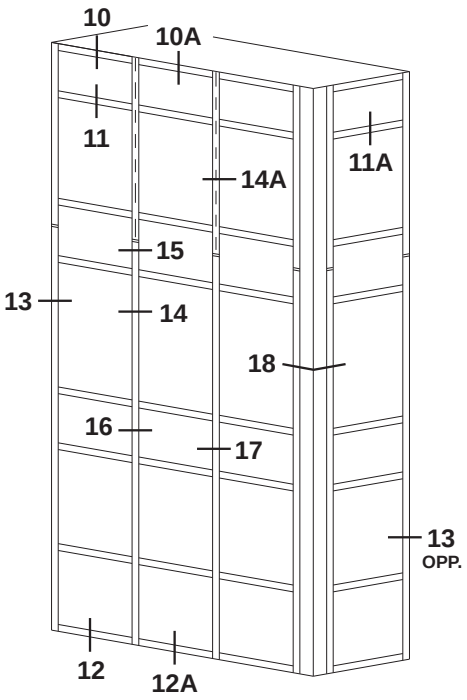
FOR DESIGN PRESSURES OF 65-90 PSF

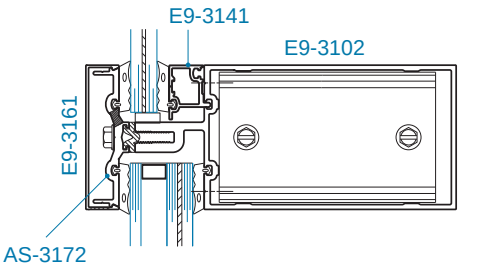


SECTION 10
HEAD w/ “F” Anchor

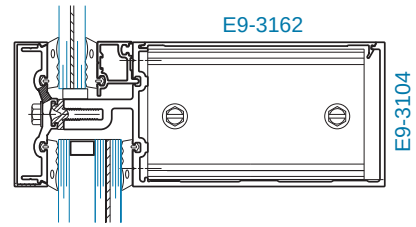


SECTION 10A
HEAD w/ “T” Anchor

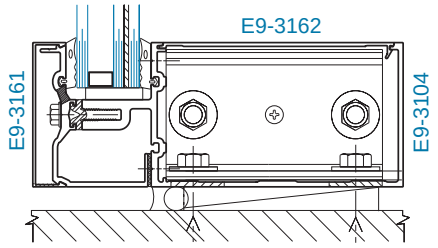




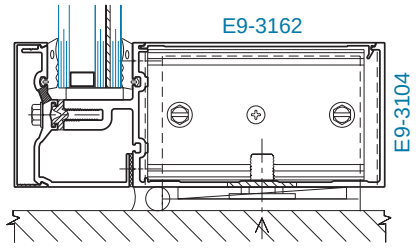
SECTION 11
HORIZONTAL (One Piece)



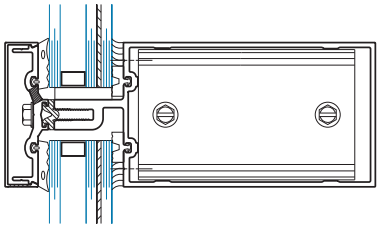
SECTION 11A
HORIZONTAL (Two-Piece)



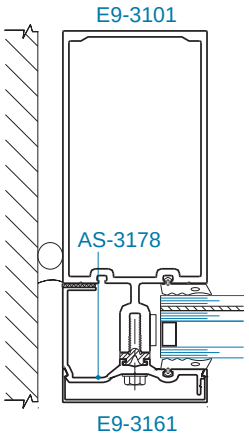
SECTION 12
SILL w/ “J” Anchor



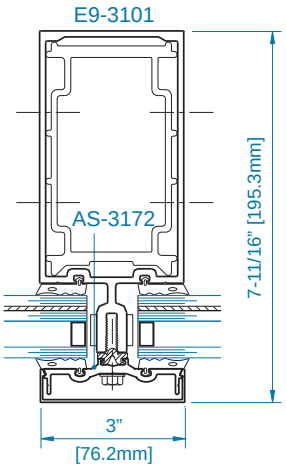
SECTION 12A
SILL w/ “T” Anchor



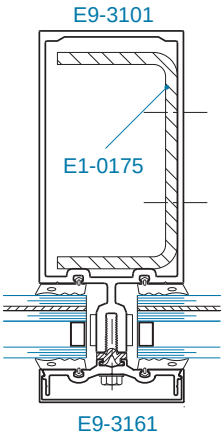
SECTION 11B
HORIZONTAL
(Optional Glazing)



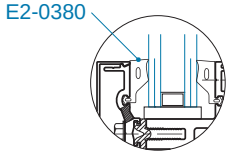
SECTION 13
JAMB



SECTION 14
MULLION @ SPLICE

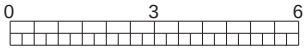


SECTION 14A
MULLION w/STEEL
AS REQUIRED

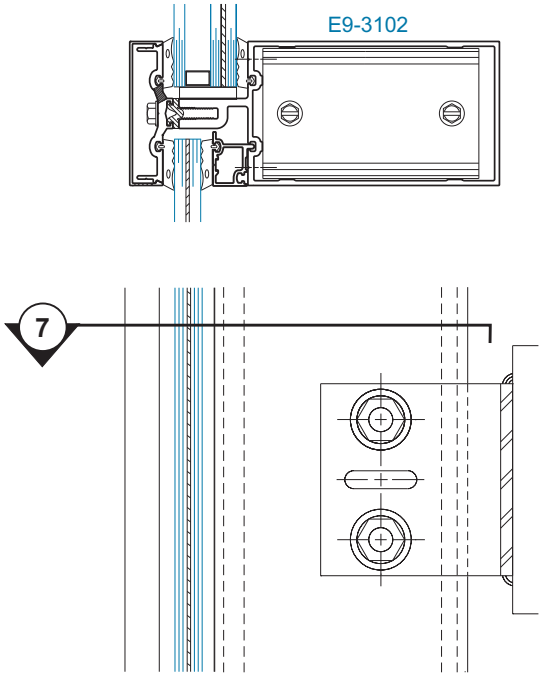


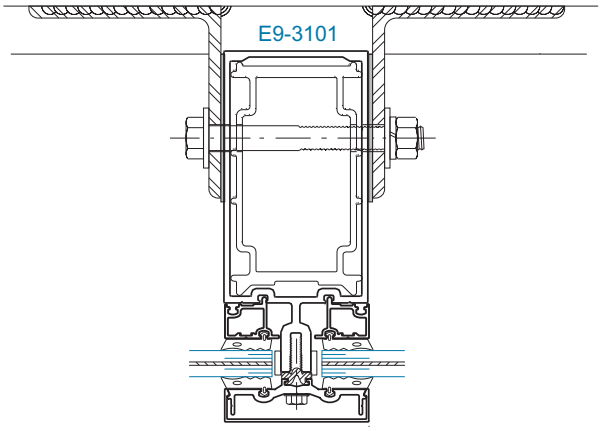
OPTIONAL 1” GLAZING
(For Non-Impact Conditions)

SCALE: 1/4 SIZE



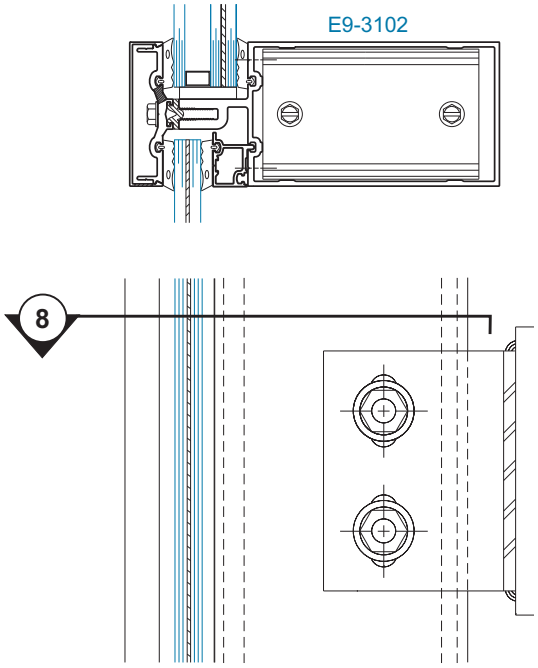
TYPICAL DEADLOAD ANCHOR

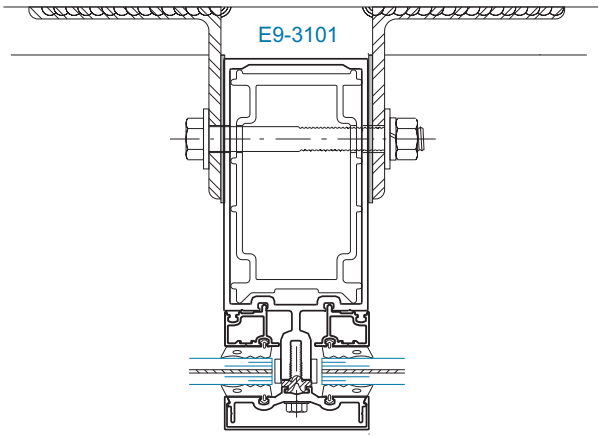




SECTION 7

TYPICAL WINDLOAD ANCHOR





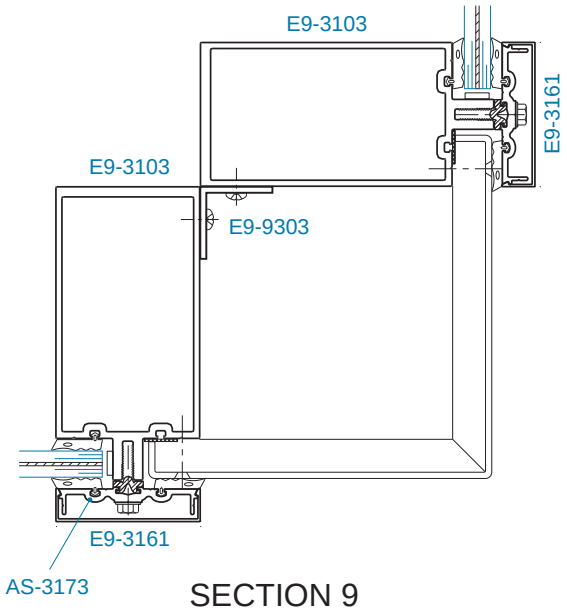
SECTION 8

SCALE: 1/4 SIZE

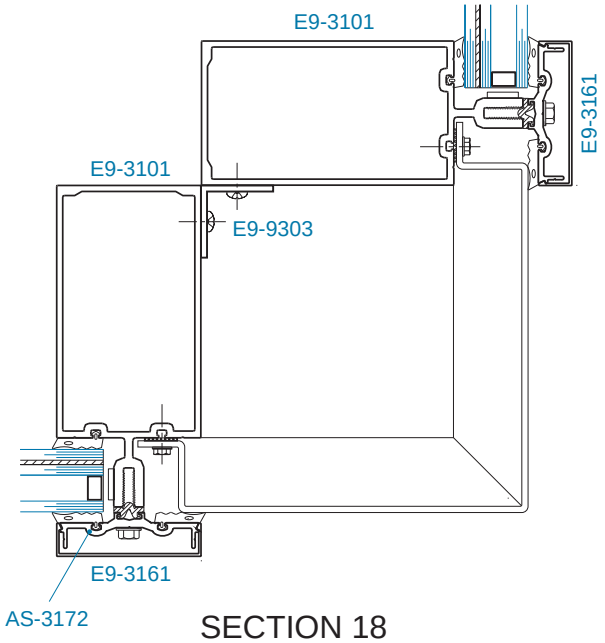
0 3 6

FOR DESIGN PRESSURES OF 65-90 PSF

STANDARD 90° CORNERS

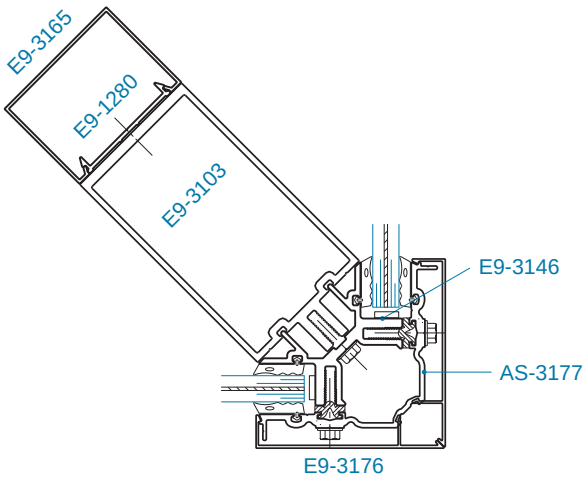


SECTION 9
90° OUTSIDE CORNER
SINGLE GLAZING

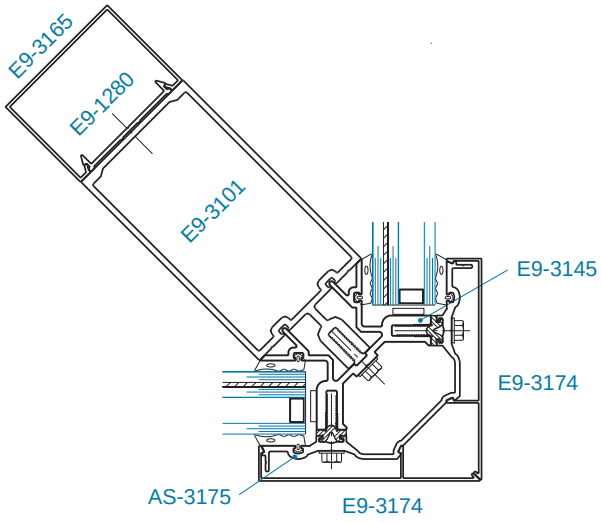


SECTION 18
90° OUTSIDE CORNER
INSULATING GLAZING

OPTIONAL 90° CORNER

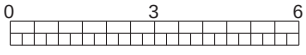


SECTION 9A
90° OUTSIDE CORNER
SINGLE GLAZING

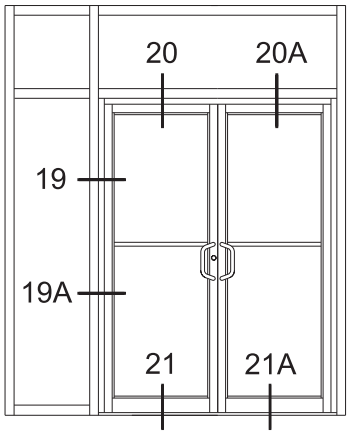


SECTION 18A
90° OUTSIDE CORNER

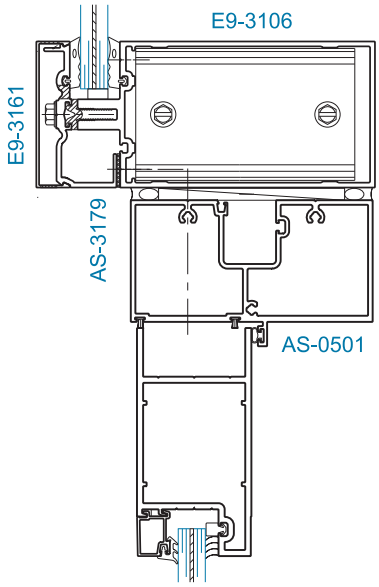
SCALE: 1/4 SIZE



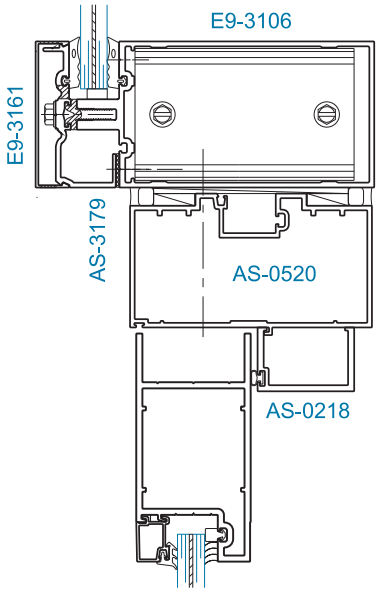
DOOR FRAMING MEMBERS WITH SINGLE GLAZING FOR DESIGN PRESSURES OF 65-90 PSF



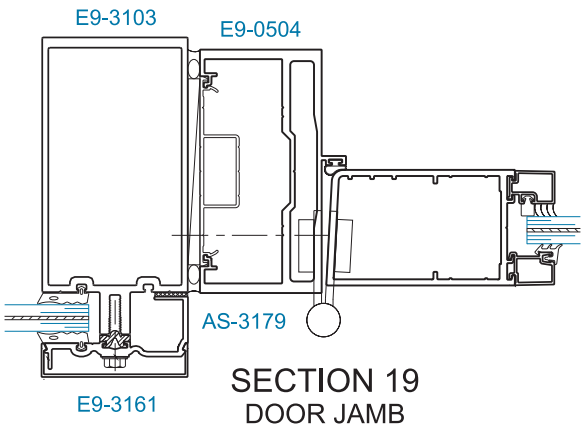
35H PAIR DOORS SHOWN



SECTION 20
STANDARD
TRANSOM BAR

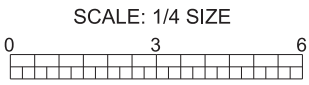


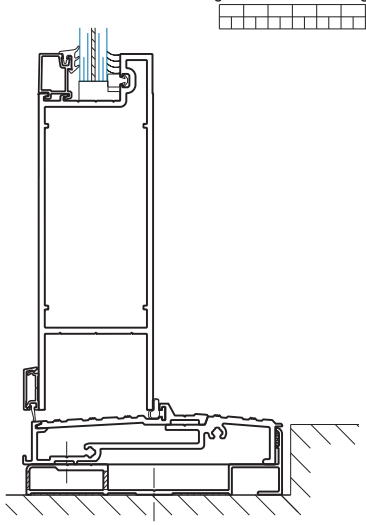
SECTION 20A
OHCC
TRANSOM BAR



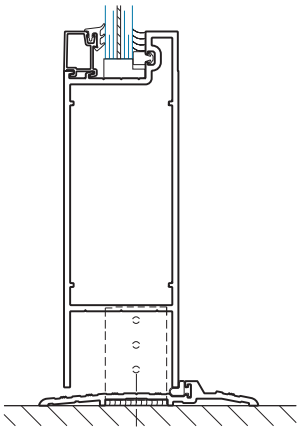
SECTION 19
DOOR JAMB
w/ BUTT HINGE

SCALE: 1/4 SIZE

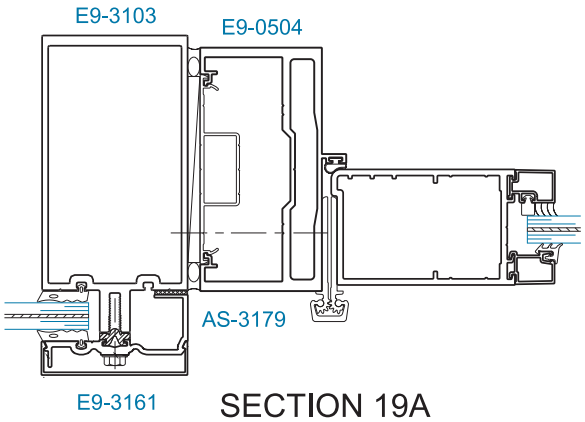




SECTION 21*
WATER RESISTANT
THRESHOLD



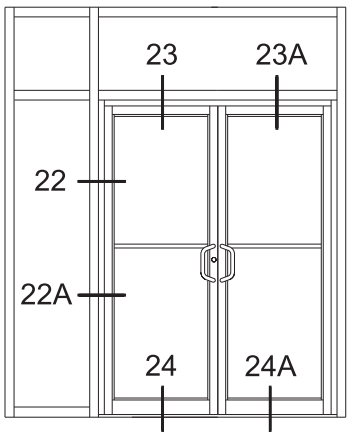
SECTION 21A**
AIR TIGHT THRESHOLD
**NOT APPROVED
FOR FLORIDA



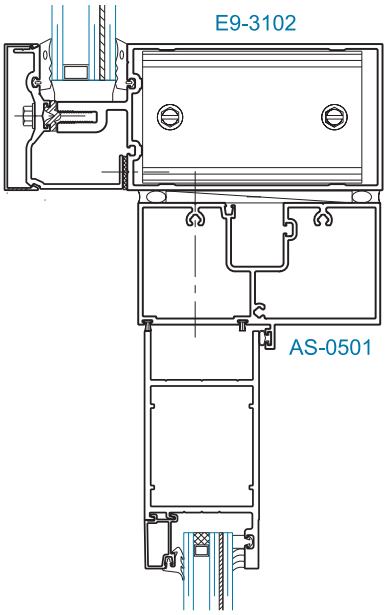
SECTION 19A
DOOR JAMB
w/ CONTINUOUS HINGE

* Frames that employ the water resistant threshold, E9-0502, and are designated as ADA entrances, require a 1:12 slope ramp. For information contact YKK AP or ADA.

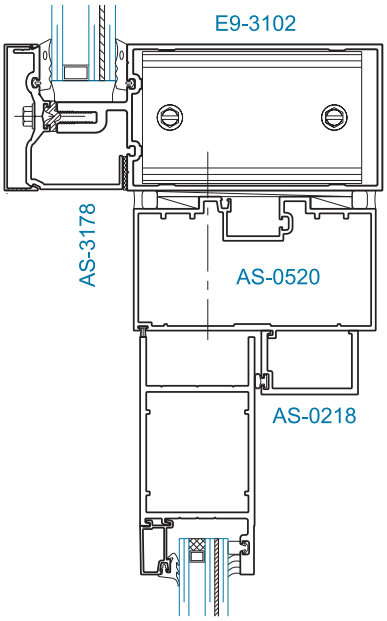
DOOR FRAMING MEMBERS WITH INSULATING GLAZING FOR DESIGN PRESSURES OF 65-90 PSF



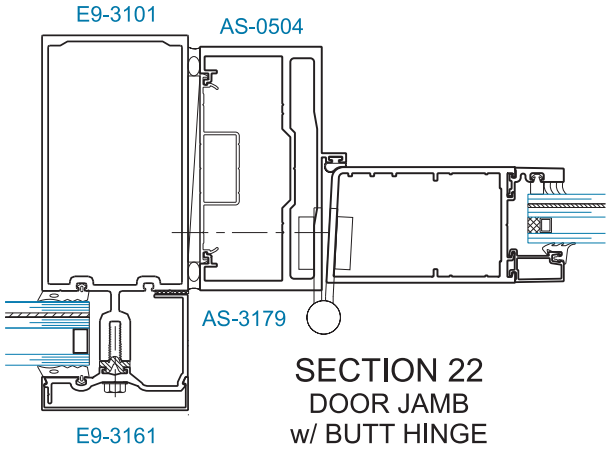
35H PAIR DOORS SHOWN



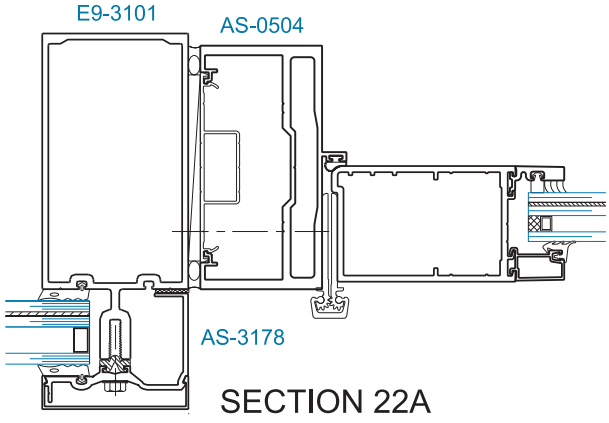
SECTION 23
STANDARD
TRANSOM BAR



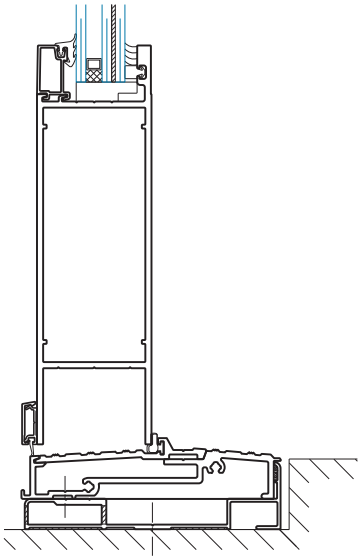
SECTION 23A
OHCC
TRANSOM BAR



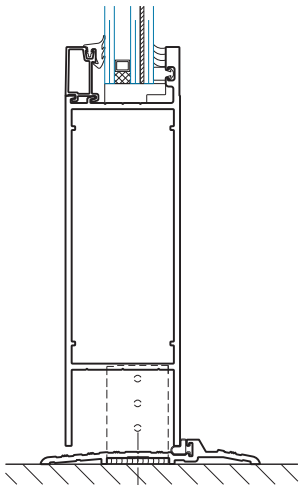
SECTION 22
DOOR JAMB
w/ BUTT HINGE



SECTION 22A
DOOR JAMB
w/ CONTINUOUS HINGE

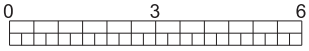


SECTION 24*
WATER RESISTANT
THRESHOLD



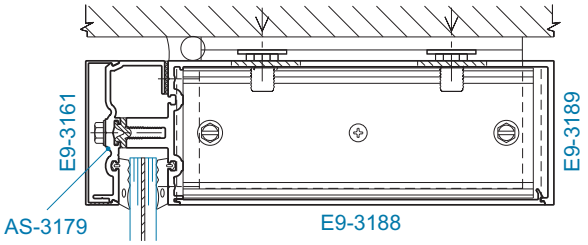
SECTION 24A**
AIR TIGHT THRESHOLD
**NOT APPROVED
FOR FLORIDA

SCALE: 1/4 SIZE



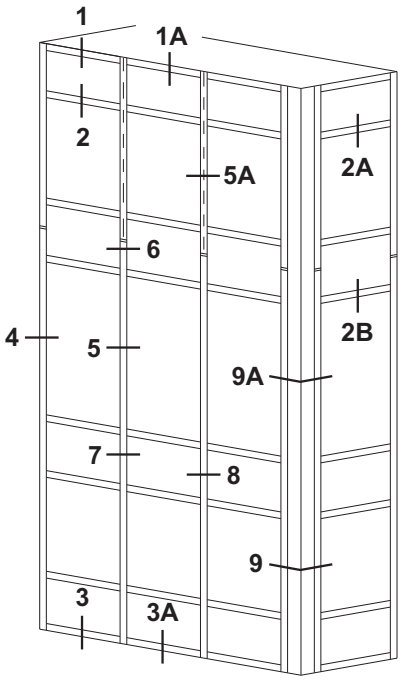
* Frames that employ the water resistant threshold, E9-0502, and are designated as ADA entrances, require a 1:12 slope ramp. For information contact YKK AP or ADA.

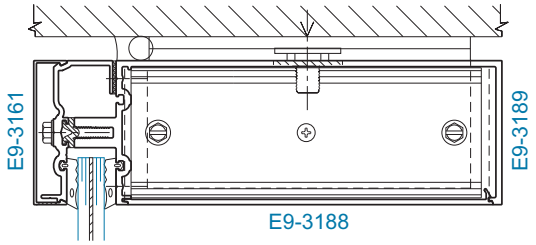
FOR DESIGN PRESSURES OF 90-130 PSF



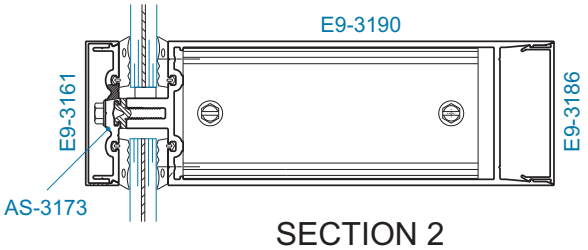
SECTION 1
HEAD w/ “F” Anchor

SCALE: 1/4 SIZE
0 3 6

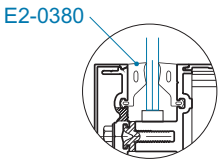




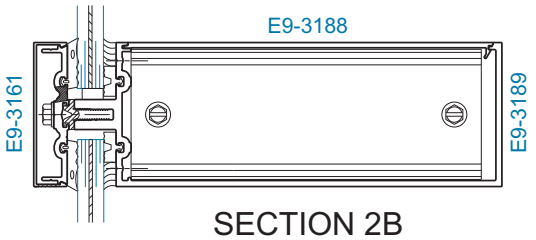
SECTION 1A
HEAD w/ “T” Anchor



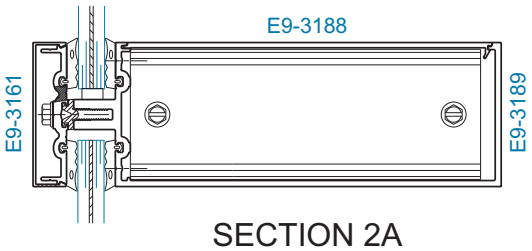
SECTION 2
HORIZONTAL (One Piece)



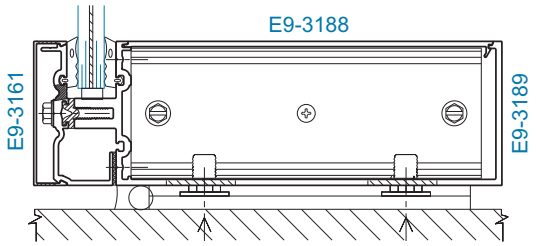
OPTIONAL 1/4” GLAZING
(For Non-Impact Conditions)



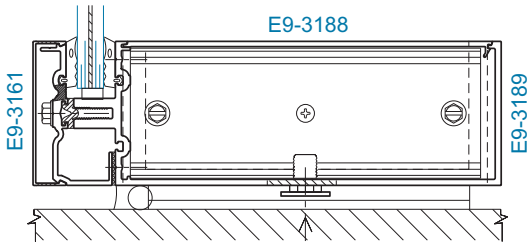
SECTION 2B
HORIZONTAL
(Optional Glazing)



SECTION 2A
HORIZONTAL (Two Piece)

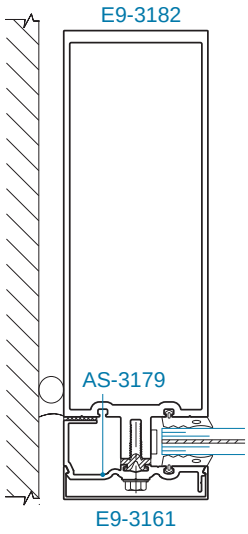


SECTION 3A
SILL w/ “F” Anchor

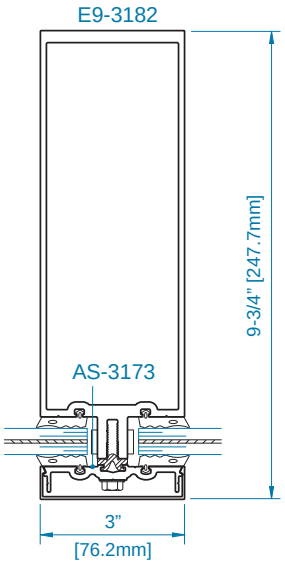


SECTION 3A
SILL w/ “T” Anchor

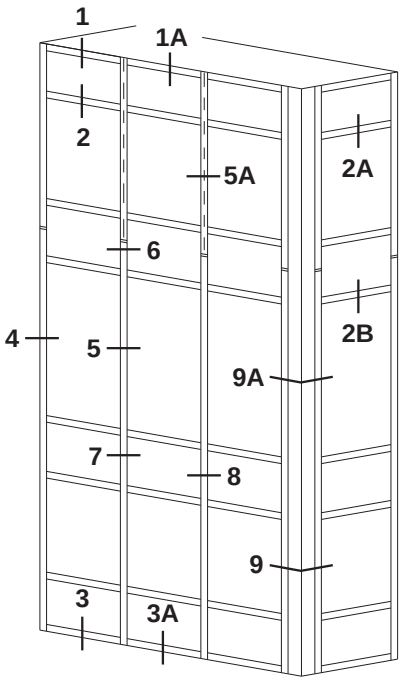
FOR DESIGN PRESSURES OF 90-130 PSF

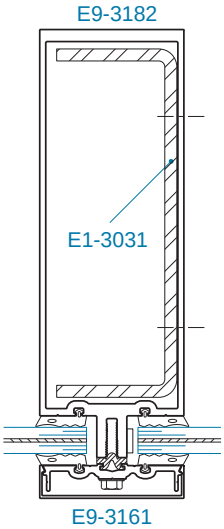


SECTION 4
JAMB

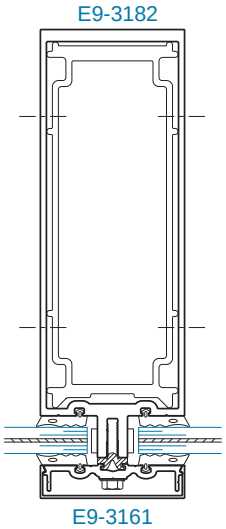


SECTION 5
MULLION

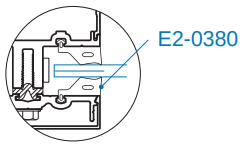




SECTION 5A
MULLION w/STEEL
AS REQUIRED

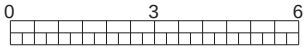


SECTION 6
MULLION @ SPLICE



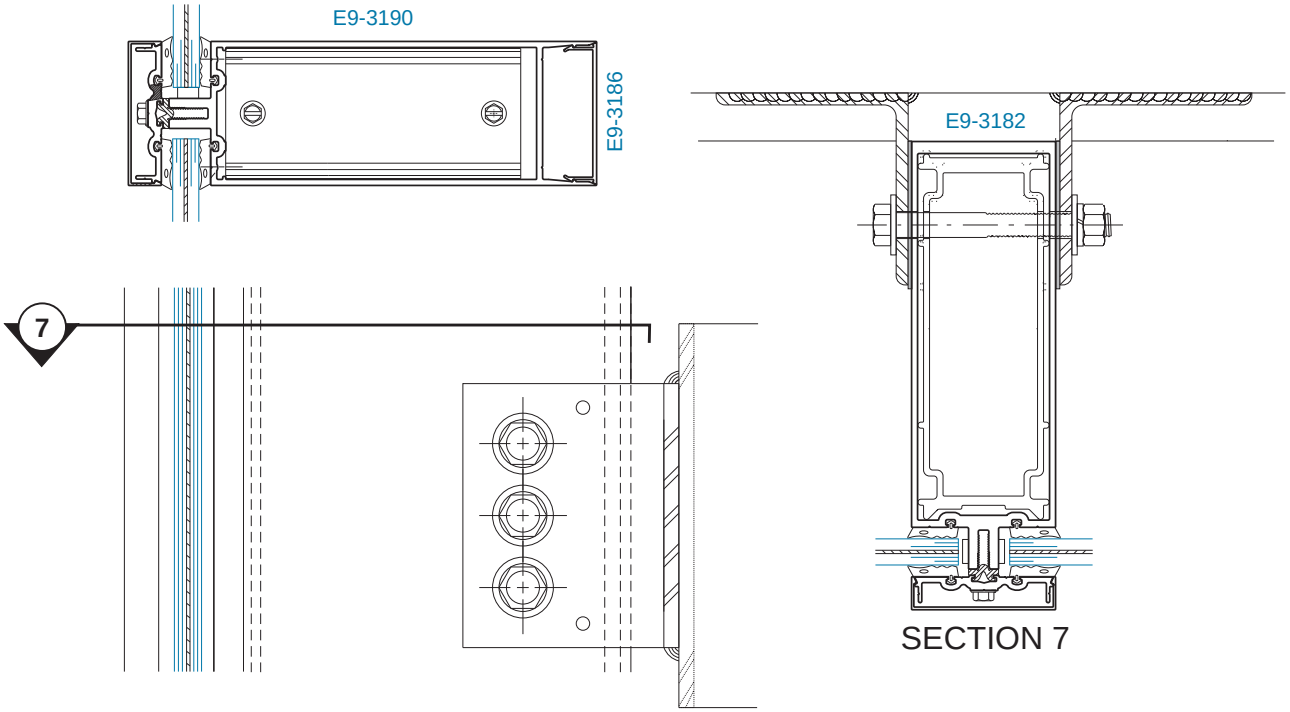
OPTIONAL 1" GLAZING
(For Non-Impact Conditions)

SCALE: 1/4 SIZE

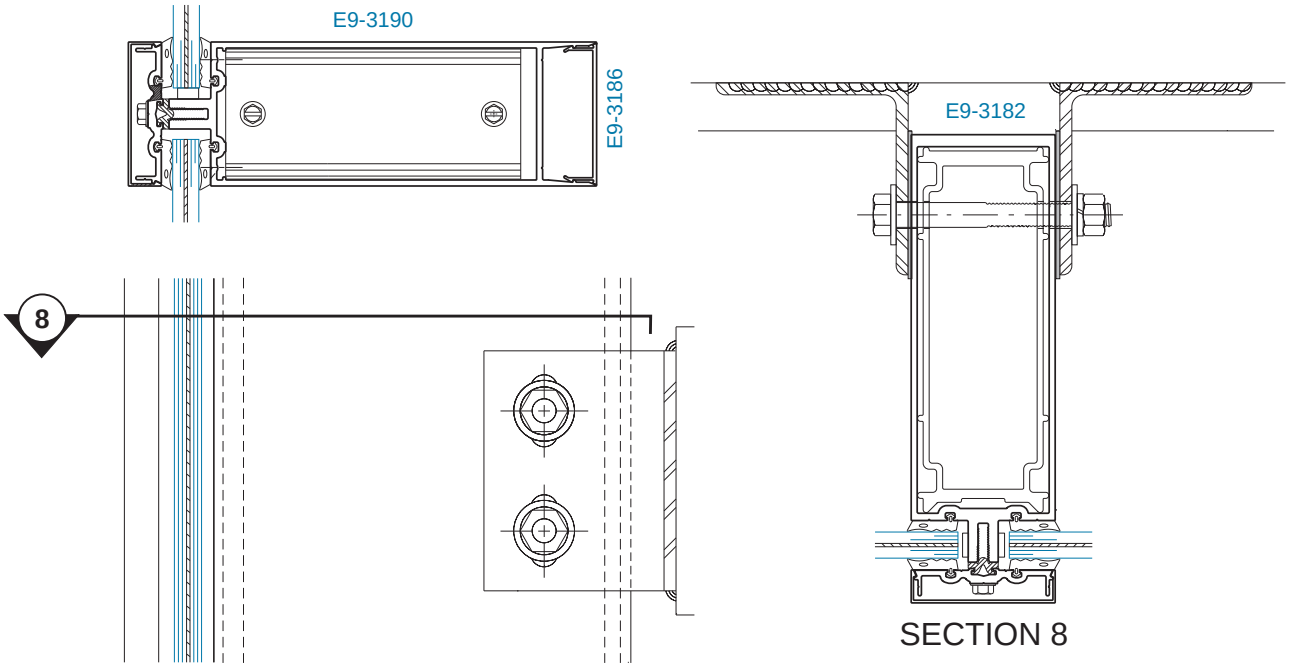


FOR DESIGN PRESSURES OF 90-130 PSF

TYPICAL DEADLOAD ANCHOR



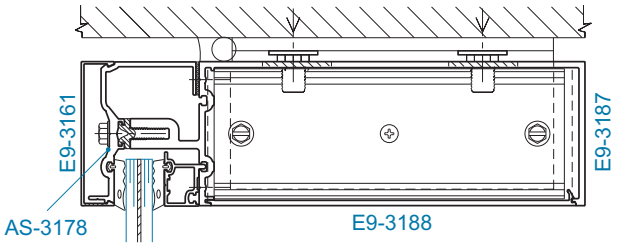
TYPICAL WINDLOAD ANCHOR



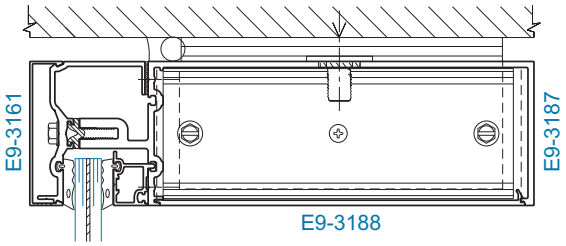
SCALE: 1/4 SIZE

0 3 6

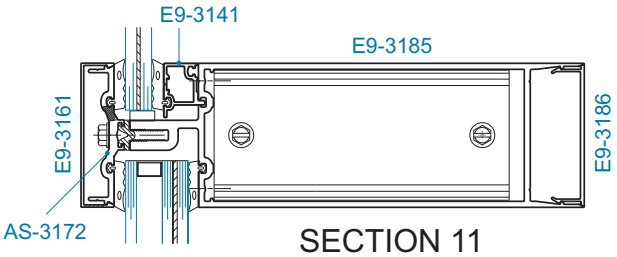
FOR DESIGN PRESSURES OF 90-130 PSF



SECTION 10
HEAD w/ “F” Anchor

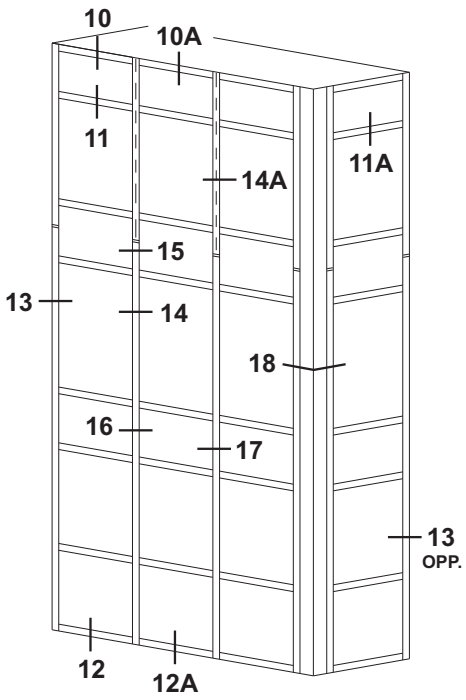


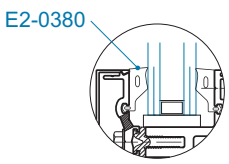
SECTION 10A
HEAD w/ “T” Anchor



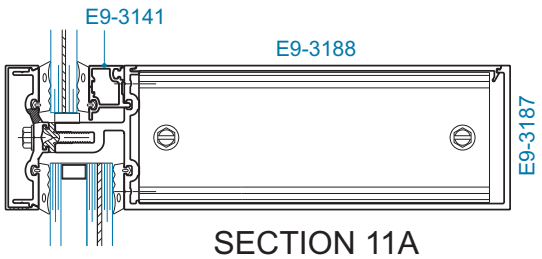
SECTION 11
HORIZONTAL (One Piece)

SCALE: 1/4 SIZE
0 3 6

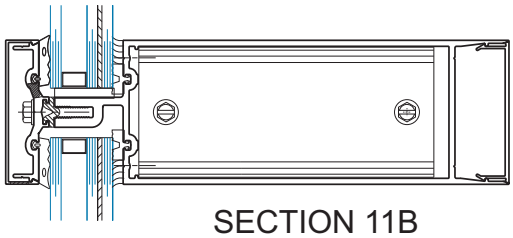




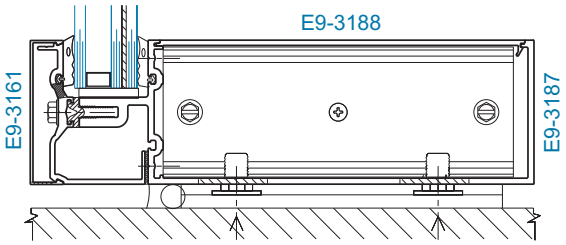
OPTIONAL 1” GLAZING
(For Non-Impact Conditions)



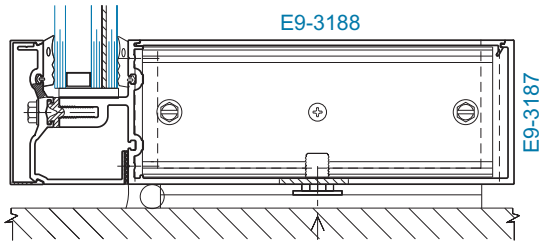
SECTION 11A
HORIZONTAL (Two Piece)



SECTION 11B
HORIZONTAL
(Optional Glazing)

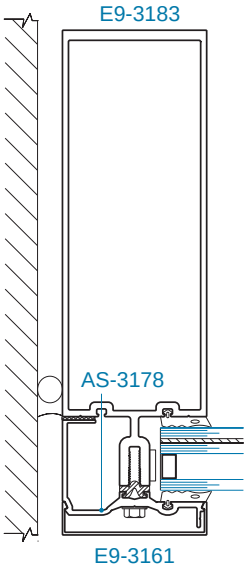


SECTION 12
SILL w/ “F” Anchor

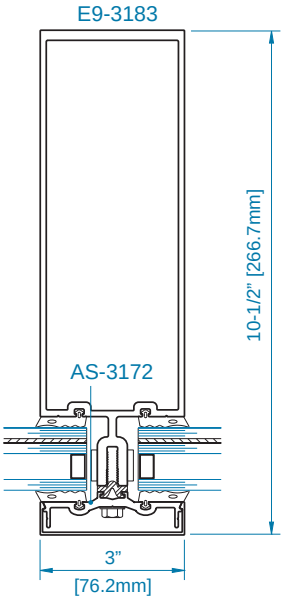


SECTION 12A
SILL w/ “T” Anchor

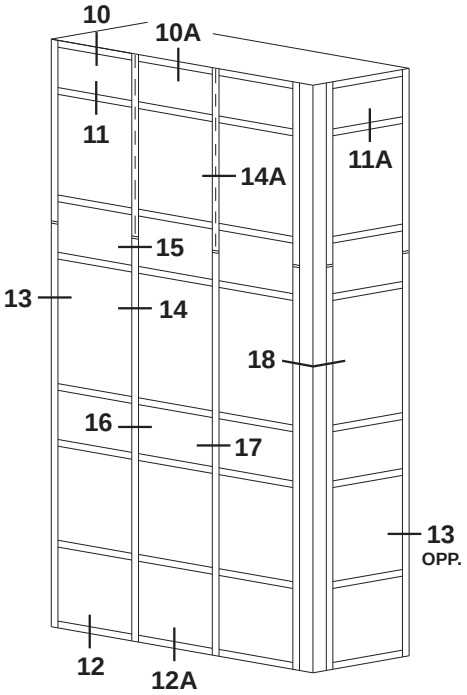
FOR DESIGN PRESSURES OF 90-130 PSF

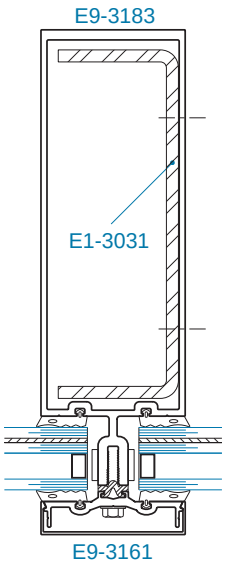


SECTION 13
JAMB

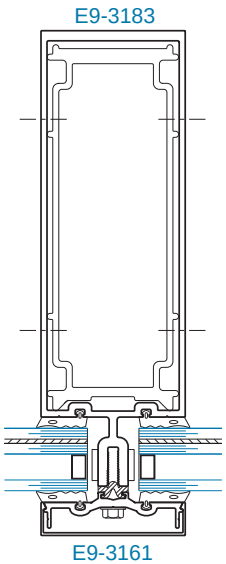


SECTION 14
MULLION

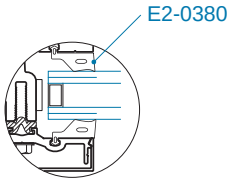




SECTION 14A
MULLION w/STEEL
AS REQUIRED

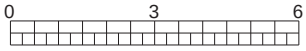


SECTION 15
MULLION @ SPLICE



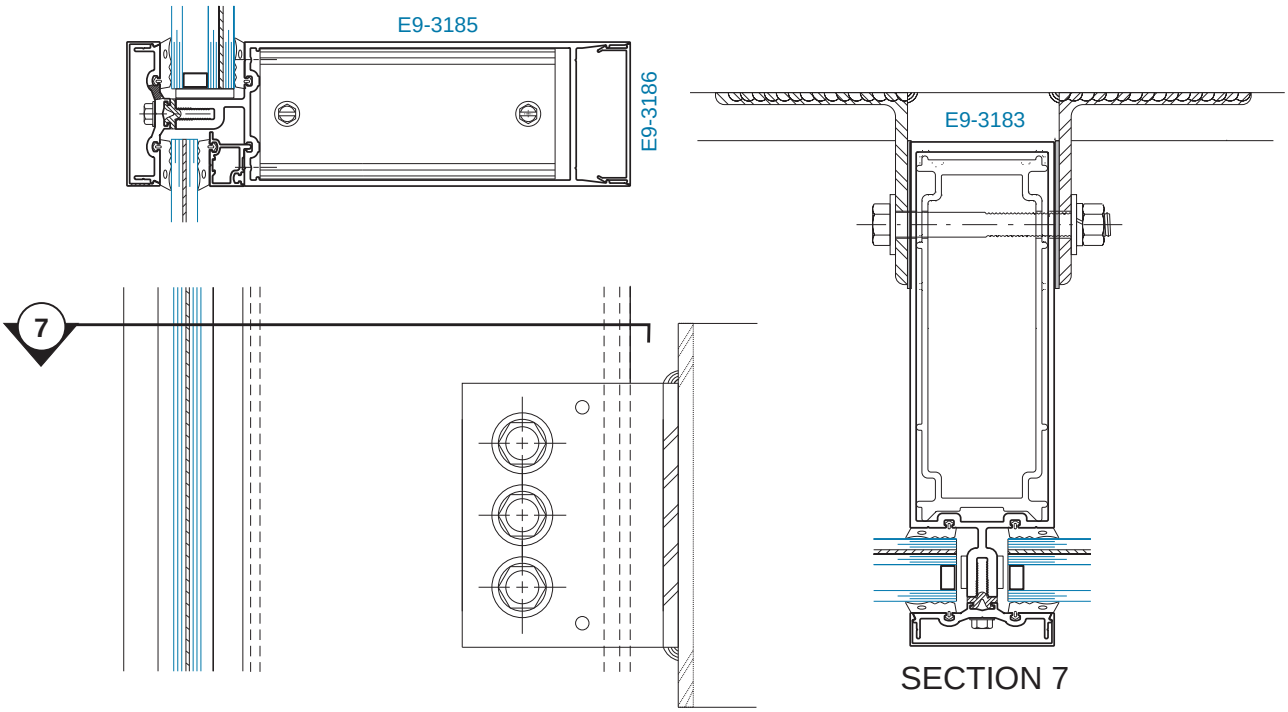
OPTIONAL 1" GLAZING
(For Non-Impact Conditions)

SCALE: 1/4 SIZE

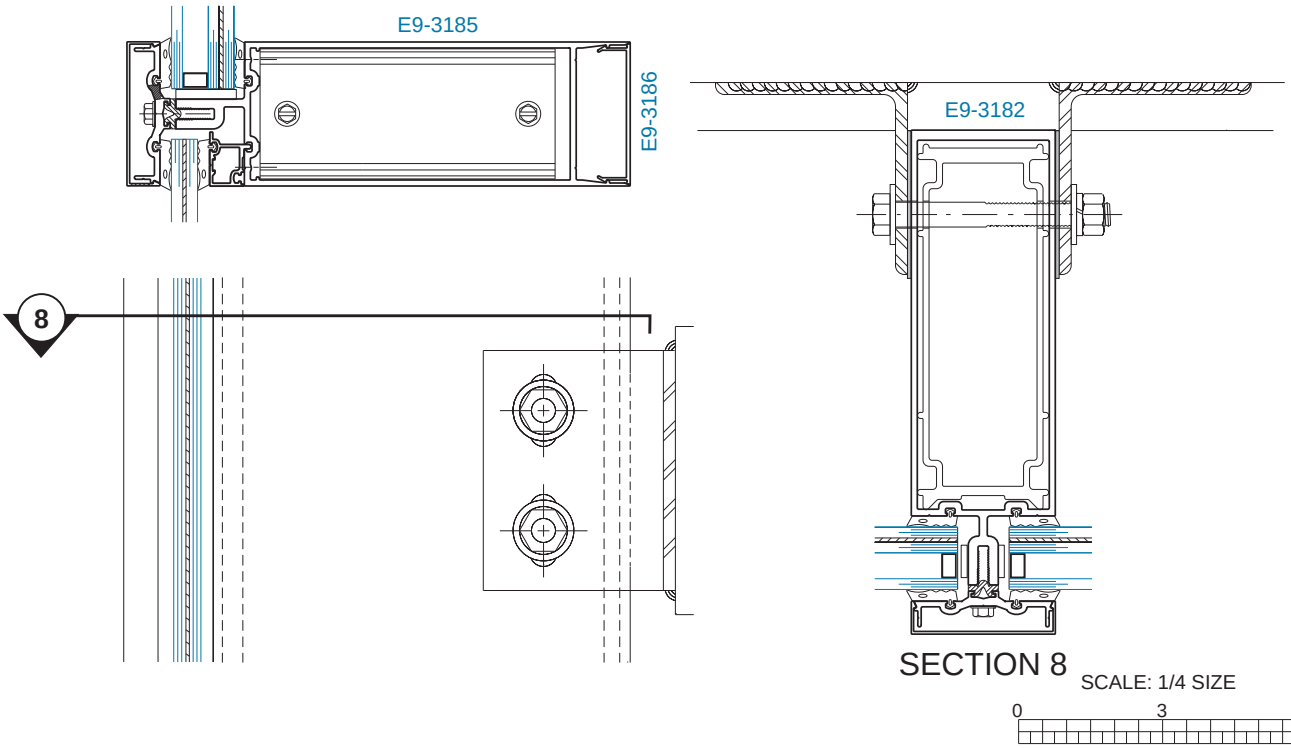


FOR DESIGN PRESSURES OF 90-130 PSF

TYPICAL DEADLOAD ANCHOR

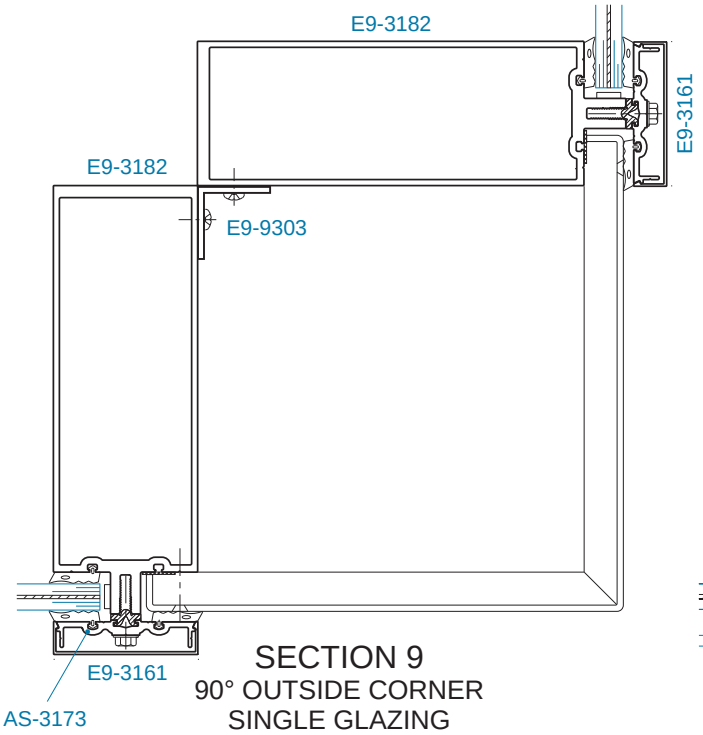


TYPICAL WINDLOAD ANCHOR

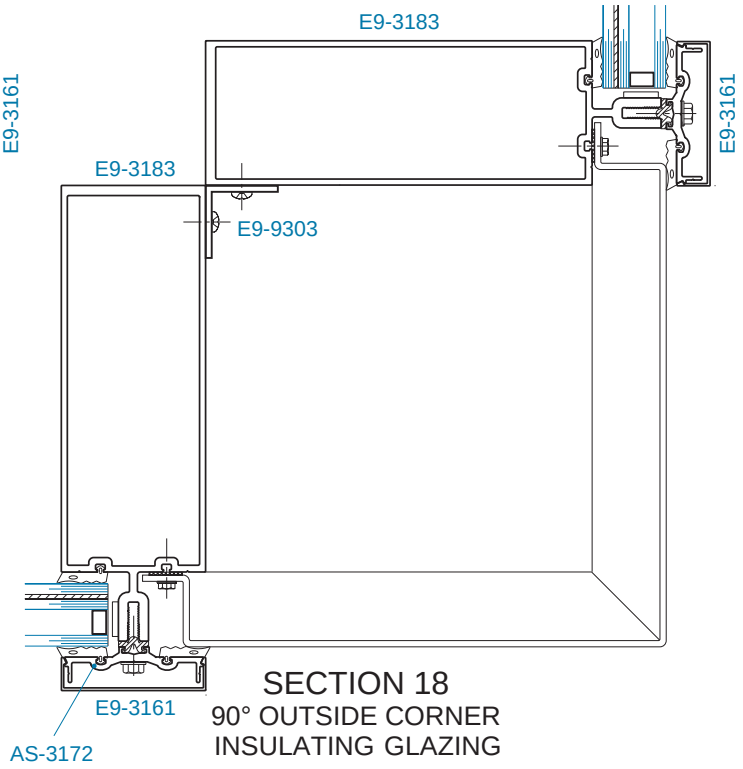


FOR DESIGN PRESSURES OF 90-130 PSF

STANDARD 90° CORNERS

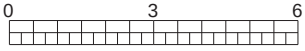


SECTION 9
90° OUTSIDE CORNER
SINGLE GLAZING



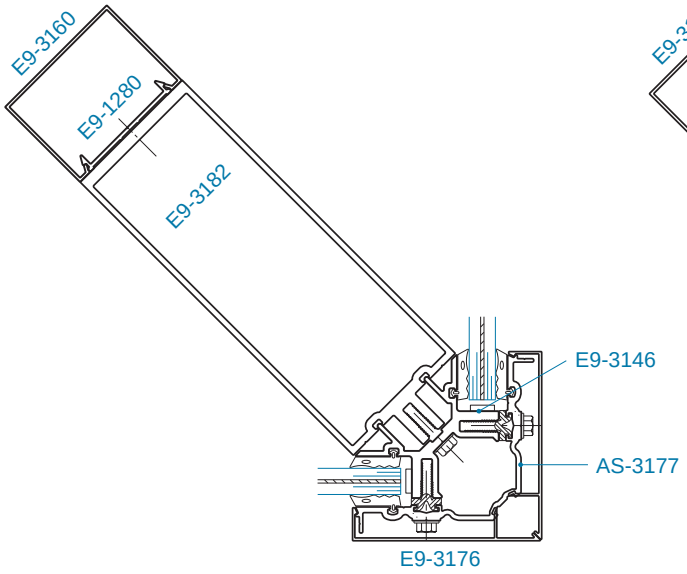
SECTION 18
90° OUTSIDE CORNER
INSULATING GLAZING

SCALE: 1/4 SIZE

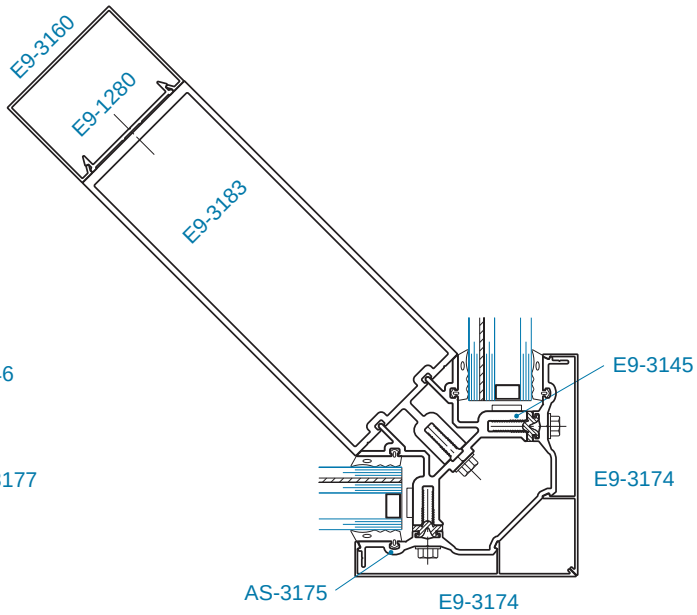


FOR DESIGN PRESSURES OF 90-130 PSF

OPTIONAL 90° CORNER

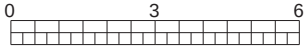


SECTION 9A
90° OUTSIDE CORNER
SINGLE GLAZING

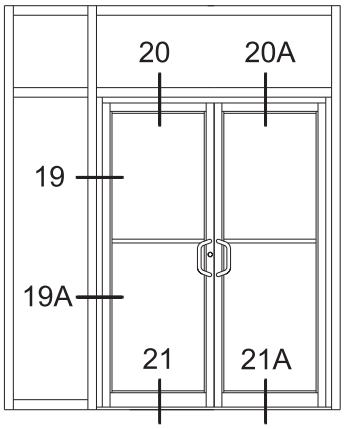


SECTION 18A
90° OUTSIDE CORNER
INSULATING GLAZING

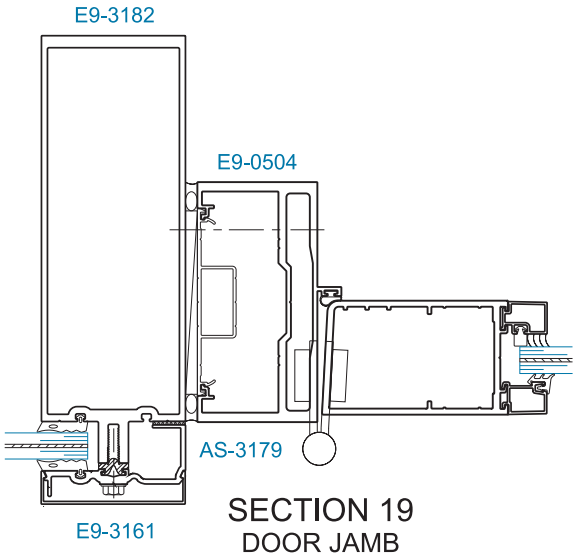
SCALE: 1/4 SIZE



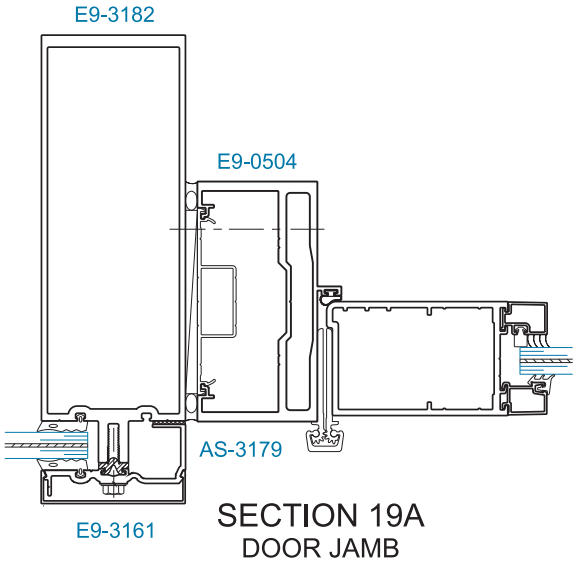
DOOR FRAMING MEMBERS WITH SINGLE GLAZING FOR DESIGN PRESSURES OF 90-130 PSF



35H PAIR DOORS SHOWN

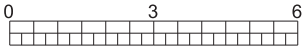


SECTION 19
DOOR JAMB
w/ BUTT HINGE

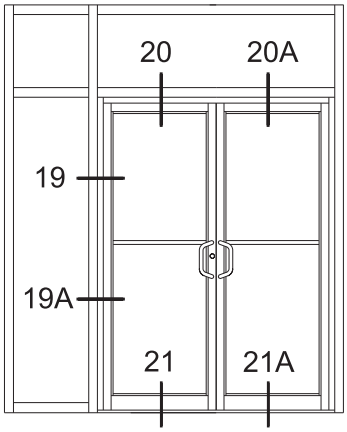


SECTION 19A
DOOR JAMB
w/ CONTINUOUS HINGE

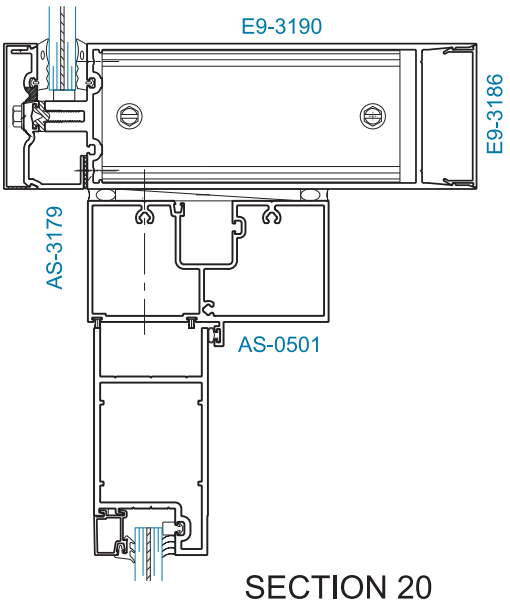
SCALE: 1/4 SIZE



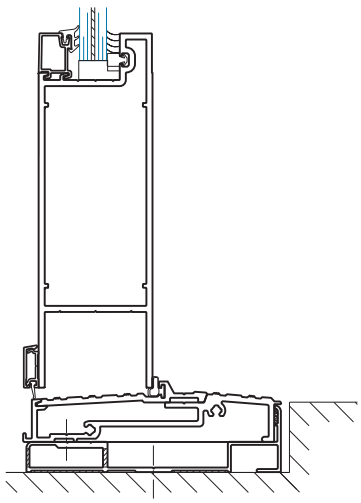
DOOR FRAMING MEMBERS WITH SINGLE GLAZING FOR DESIGN PRESSURES OF 90-130 PSF



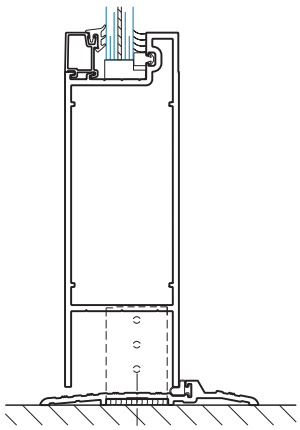
35H PAIR DOORS SHOWN



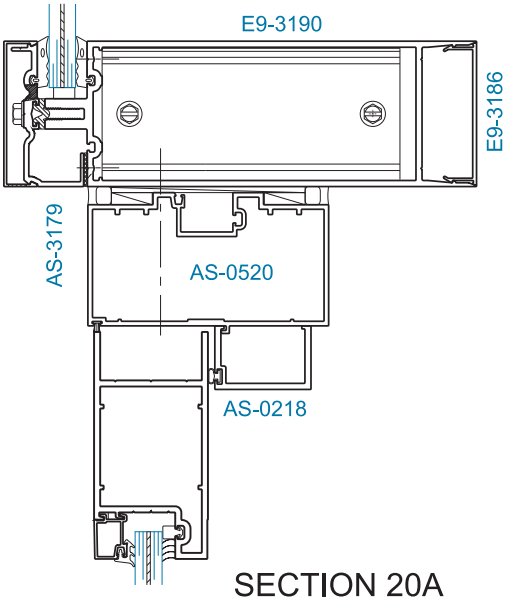
SECTION 20
STANDARD
TRANSOM BAR



SECTION 21*
WATER RESISTANT
THRESHOLD

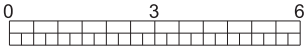


SECTION 21A**
AIR TIGHT THRESHOLD
**NOT APPROVED
FOR FLORIDA



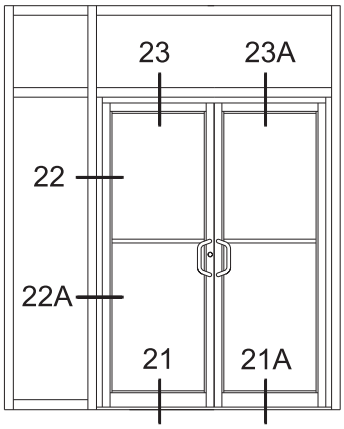
SECTION 20A
OHCC
TRANSOM BAR

SCALE: 1/4 SIZE

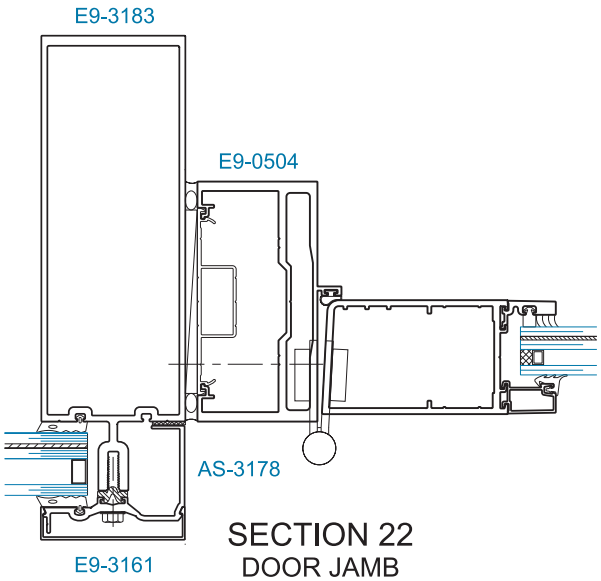


* Frames that employ the water resistant threshold, E9-0502, and are designated as ADA entrances, require a 1:12 slope ramp. For information contact YKK AP or ADA.

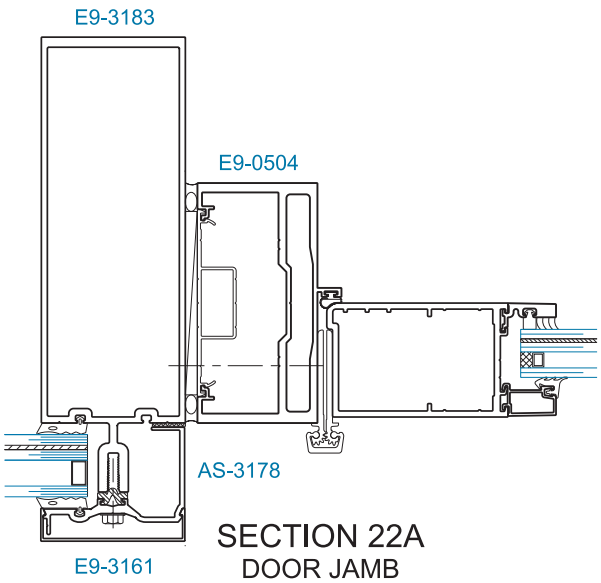
DOOR FRAMING MEMBERS WITH INSULATING GLAZING FOR DESIGN PRESSURES OF 90-130 PSF



35H PAIR DOORS SHOWN

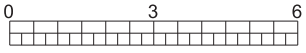


SECTION 22
DOOR JAMB
w/ BUTT HINGE

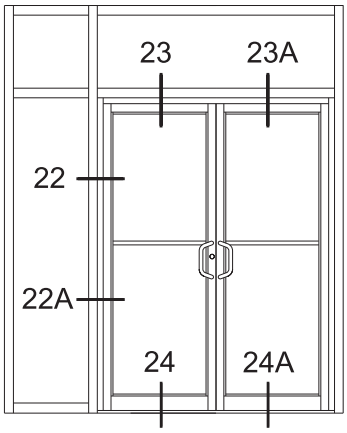


SECTION 22A
DOOR JAMB
w/ CONTINUOUS HINGE

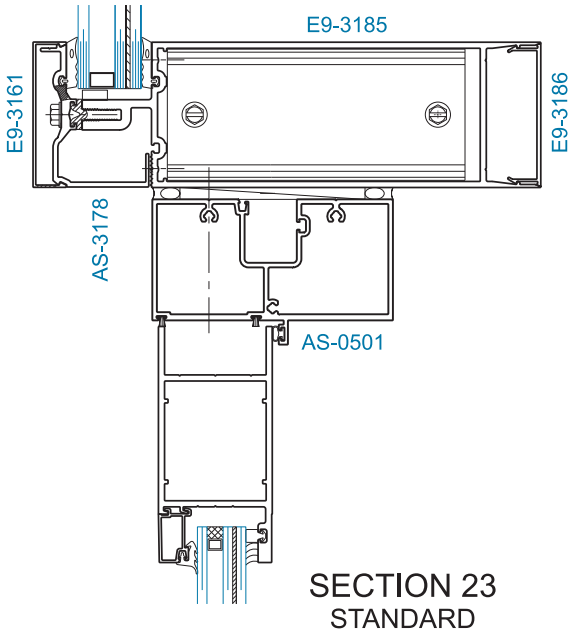
SCALE: 1/4 SIZE



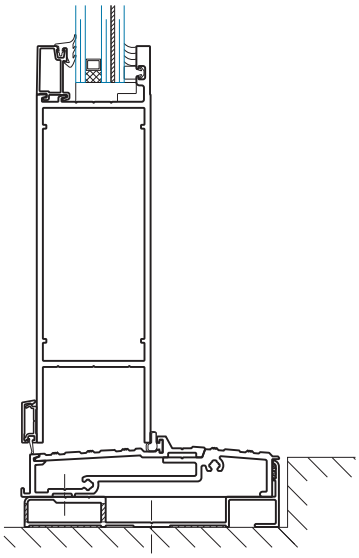
DOOR FRAMING MEMBERS WITH INSULATING GLAZING FOR DESIGN PRESSURES OF 90-130 PSF



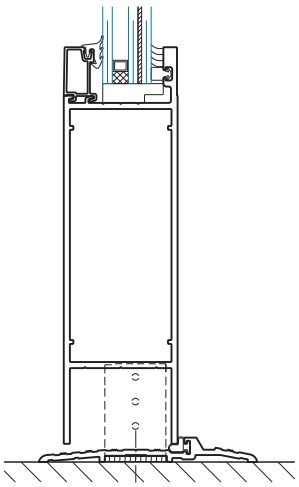
35H PAIR DOORS SHOWN



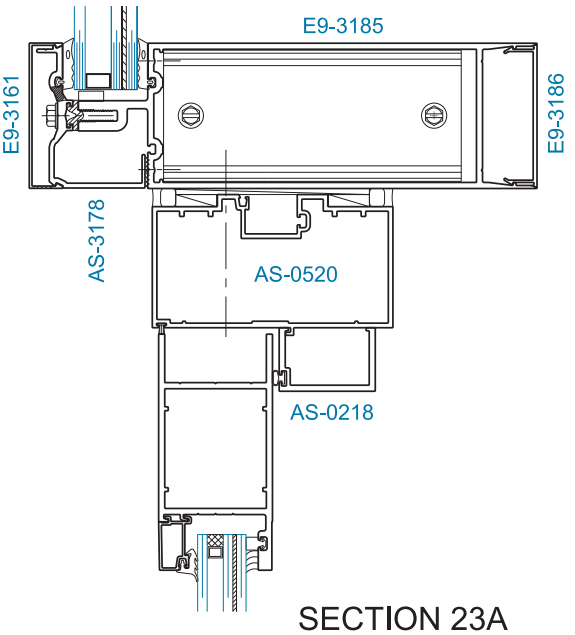
SECTION 23
STANDARD
TRANSOM BAR



SECTION 24*
WATER RESISTANT
THRESHOLD



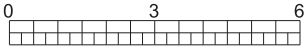
SECTION 24A**
AIR TIGHT THRESHOLD
**NOT APPROVED
FOR FLORIDA



SECTION 23A
OHCC
TRANSOM BAR

* Frames that employ the water resistant threshold, E9-0502, and are designated as ADA entrances, require a 1:12 slope ramp. For information contact YKK AP or ADA.

SCALE: 1/4 SIZE



FLORIDA | GEORGIA | TEXAS
CORPORATE HEADQUARTERS
6655 Garden Road
Riviera Beach, FL 33404
(561)-881-0020
HTLTEST.COM

YKK AP AMERICA, INC.

Curtainwall
Test Report #: 0231-0807-09

1.0 MANUFACTURER'S IDENTIFICATION

1.1	Name of Applicant:	YKK AP AMERICA, INC. 7680 The Bluffs, Suite 100 Austell, GA 30168 Voice: (678) 838-6095 Fax: (678) 838-6056
1.2	Contact Person:	Don Pangburn

2.0 LABORATORY IDENTIFICATION

2.1	HTL Test Notification:	N/A
2.2	HTL Lab Certifications:	Miami-Dade County (05-1014.01); Florida Building Code (TST1527); IAS (TL-244); AAMA; WDMA; Keystone Certificate; Texas Department of Insurance

3.0 SCOPE OF WORK

3.1 Introduction

YKK AP AMERICA, INC. retained HTL, LLC to conduct Florida Building Code standard testing on their YHC 300 O.G. Curtainwall system.

3.2 Report Information

Table 3.1 provides the test dates for the mock-up and specimen number.

Table 3.1: Specimen Test Dates

Mock-Up	Specimen #	Test Date
TS1	2	9/29/09 – 10/22/09

4.0 PRODUCT IDENTIFICATION

4.1	Product Type:	Curtainwall
4.2	Model Designation:	YHC 300 O.G.
4.3	Performance Class:	+/-55 psf Design Pressure

VINU J. ABRAHAM LICENSE NO. 53820 STATE OF FLORIDA PROFESSIONAL ENGINEER

ENGINEER OF RECORD
Vinu J. Abraham, P.E.
FL Reg. #53820
11/3/09

REPORT WRITER
Angela Abramczyk
11/3/09

4.4 Overall Size & Configuration: Table 4.1 provides the overall size for the mock-up/specimen number. The table also indicates which YKK AP AMERICA, INC. drawing number and sheet to see for the configuration of this mock-up.

Table 4.1: Specimen Overall Size

Mock-Up	Specimen #	Overall Size	Drawing/Sheet #
Elevation TS1 (2)	2	183" (w) x 295-1/2" (h)	ELEV-TS1/TS1

4.5 Number of Operable Panels: None

4.6 Drawing: This test report is incomplete if not accompanied by the YKK AP AMERICA, INC. drawing numbers indicated in Table 4.2. bearing the ink stamp of Hurricane Test Laboratory, LLC.

Table 4.2: Drawing Numbers

Elevation #	Drawing #	Sheets
TS1 (2)	ELEV-TS1	TS1
TS1 (2)	DET- TS1	1 - 5

4.7 Sample Source: Sample provided by YKK AP AMERICA, INC.

5.0 PRODUCT DESCRIPTION

5.1 Frame Construction

The framing members were fabricated using the aluminum extrusions defined in Table 5.1.

Table 5.1: Aluminum Extrusion Details

Description	Part #	Overall Cross-Section	Alloy/Temper
Head & Sill	E9-3105	6.110" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (left bay)	E9-3105	6.110" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (all other areas)	E9-3106	6.110" x 3.000" x 0.100"	6063-T5
Mullion	E9-3107	3.000" x 6.120" x 0.100"	6063-T6
Flush Filler (for E9-3105)	E9-3162	4.890" x 0.331" x 0.079"	6063-T5

5.1.1 Typical Frame Corner Construction

At each corner, the vertical frame member ran through while the horizontal frame member end was square cut, butted and mechanically fastened to the vertical frame member via a 4-1/2" (long) aluminum shear block (Part #E1-3001). At each frame corner, the shear block was attached to the vertical frame member using two (2), ¼"-20 x 5/8" HWH TCS (Type F). Each horizontal frame member end was attached to the adjacent shear block using two (2), #12 x 1-1/4" FH SMS (Type AB).

5.1.2 Frame Joint Sealant

At each frame joint, the exterior leg of each horizontal frame member was sealed with a bead of Tremco® Spectrem 2® silicone sealant prior to its attachment to the shear block.

5.1.3 End Cap & Anchor Sleeve Construction

There was a mullion end cap (Part # E1-3011) attached to the top and bottom end of each mullion and jamb using one (1), #14 x 5/8" FH SMS. NOTE: One (1), 3" long anchor sleeve (Part #E1-3006) was inserted into the top and bottom of each mullion end and secured in place using two (2), #10 x 5/8" PH SMS (Type AB).

5.1.4 Miscellaneous Construction

There was a continuous filler (Part # E9-3162) used at the interior frame head, sill and some intermediate horizontal (see above Table 5.1 "Aluminum Extrusion Details" for where the intermediate horizontals would apply) locations between each mullion.

5.2 Pressure Plate and Snap Cover Assembly

Table 5.2 provides the extrusions used in the pressure plate and snap cover assemblies.

Table 5.2: Pressure Plate and Snap Cover Details

Description	Part #	Overall Cross-Section	Alloy/Temper
Perimeter Pressure Plate	E9-3179	2.955" x 1.489" x 0.100"	6063-T5
Intermediate Horizontal/Vertical Pressure Plate	E9-3173	2.910" x 0.566" x 0.115"	6063-T5
Snap Cover	E9-3161	3.000" x 0.687" x 0.056"	6063-T5

5.2.1 Pressure Plates

Each continuous pressure plate (Part # E9-3179 or E9-3173) was square cut at each end and secured to the adjacent frame member using a single row of ¼"-20 x 1-1/4" HWH MS spaced 1-1/2" from each end and at 9" on center thereafter. NOTE: A continuous EPDM thermal isolator (Part # E2-0103) was applied to the centerline of each pressure plate prior to its installation. A continuous strip of 0.125" x 0.688" sponge isolator tape (Part # E2-0356) was applied to the perimeter leg of each perimeter pressure plate prior to its installation. The "AS" part #s called out in the details are the assembled pressure plates with this EPDM thermal isolator and (if applicable) the sponge isolator tape applied to the perimeter pressure plate. YKK AP AMERICA, INC. does not produce separate drawings for "AS" part numbers.

5.2.2 Snap Covers

At the exterior of all pressure plates, the snap covers (Part # E9-3161) were snap fit to the pressure plate.

5.3 Splice Construction

The vertical members used in this test specimen consisted of two separate sections, i.e., a 114" long lower section and a 181" long upper section. The lower and upper sections of the vertical members were each spliced together using a 6" long splice sleeve (Part # E1-3005). At each splice location, first a #8-32 x ½" FH TCS (Type F) was secured to the lower section, then the splice sleeve was inserted into the lower section and allowed to rest on top of this fastener. Finally, two (2), #12 x ¾" FH SMS (Type AB) were applied to each side of the vertical, passed through the lower section and threaded into the splice sleeve.

5.4 Vertical Reinforcement

The vertical members were reinforced at the mid-point of the dead load anchor locations using the part defined in Table 5.3.

Table 5.3: Vertical Reinforcement Details

Description	Part #	Overall Cross-Section	Material
Vertical Reinforcement Sleeve	E1-3007	2.734" x 4.860" x 0.125"	6063-T5

5.4.1 Vertical Reinforcement Sleeve

Each 29" long vertical reinforcement sleeve (Part # E1-3007) was attached to the adjacent vertical member via the dead load anchor fasteners.

5.5 Glazing Details

5.5.1 Glass Type C consisted of 9/16" thick (nominal) laminated glass consisting of the following components:

- ¼" heat strengthened glass
- 0.060" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

Glass Type G consisted of 9/16" thick (nominal) laminated glass consisting of the following components:

- ¼" heat strengthened glass
- 0.060" DuPont Butacite® PVB Interlayer (Miami-Dade NOA #05-1208.02)
- ¼" heat strengthened glass

Glass Type I consisted of 9/16" thick (nominal) laminated glass consisting of the following components:

- ¼" heat strengthened glass
- 0.035" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

5.5.2 Glazing Method

The glass lites used in this test specimen were exterior glazed on both the interior and the exterior side using strips of EPDM gasket (Part # E2-0379).

5.5.3 Daylight Opening and Glass Bite

The glass types for each lite were per the YKK AP AMERICA, INC. drawing numbers and sheets indicated in Table 5.4, without modifications.

Table 5.4: Daylight Opening and Glass Bite Details

Elevation #	Qty.	Daylight Opening	Glass Bite	Drawing #	Sheet #
TS1 (2)	9	57" (w) x 94-1/2" (h)	15/16"	ELEV-TS1	TS1

5.6 Weather Stripping

None used

5.7 Hardware
None used

5.8 Weep Holes, Water Diverters, and Covers
Table 5.5 provides the weep holes used in this test specimen.

Table 5.5: Weep Hole Details

Qty.	Location	Description
2/snap cover	At the third points of each exterior horizontal snap cover	5/16" diameter weep hole
3/member	3" from each end and at the centerline of each horizontal frame member	5/16" diameter weep hole

5.9 Sealants Used
Table 5.6 provides a summary of the sealants used in this test specimen.

Table 5.6: Sealant Details

Elevation #	Location	Sealant Description
TS1 (2) – head & sill	Perimeter Sealant	Tremco® Spectrem 2® silicone sealant
TS1 (2) – jambs	Perimeter Sealant	Silicone sheet
TS1 (2)	Frame Joint Sealant	Tremco® Spectrem 2® silicone sealant
N/A	Glazing Sealant	None used

6.0 PRODUCT INSTALLATION

Table 6.1 provides a detailed summary of the product installation into the steel opening. The rough opening allowed for a 2" shim space at the jambs. The rough opening allowed for a 1" shim space in all other areas.

Table 6.1: Product Installation Details

Elevation #	Location	Description	Installation	
			Test Opening	Frame member
TS1 (2)	Jambs	"F" anchor (Part # E1-3004)	Two (2), 3/8-16 x 1" HH bolts	Slide in
TS1 (2)	Intermediate Mullions	"T" anchor (Part # E1-3003)	Two (2), 3/8-16 x 1" HH bolts	Slide in
TS1 (2)	Jambs @ 150" from sill	Dead load anchor (Part # E1-1205)	3/16" long fillet weld along the top and bottom edges of the angle leg that was against the opening	Two (2), 1/2"-13 x 4-1/2" Grade 5 bolts w/matching nuts and washers
TS1 (2)	Intermediate Mullions @ 150" from sill	Two (2) dead load anchors (Part # E1-1205)	3/16" long fillet weld along the top and bottom edges of the angle legs that were against the opening	Two (2), 1/2"-13 x 4-1/2" Grade 5 bolts w/matching nuts and washers

NOTE: Each dead load anchor was installed with a nylon slip pad (Part # E3-0103) between it and the steel substrate. At all dead load anchor locations the bolts pass through the reinforcement sleeve.

7.0 TEST SEQUENCE

Table 7.1 provides a summary of the test sequence for the specimen tested.

Table 7.1: Test Sequence

Test Specimen TS1(2)
1. Air Infiltration Test
2. Water Infiltration Test
3. Dynamic Water Infiltration Test
4. Interstory Displacement
5. Air Infiltration Test
6. Water Infiltration Test
7. Water Infiltration Test
8. Positive Pre-Load
9. Positive Design Load
10. Negative Pre-Load
11. Negative Design Load
12. Water Infiltration Test
13. Positive Overload
14. Negative Overload

8.0 TEST RESULTS

8.1 Air Infiltration Test

8.1.1 Results – Air Infiltration Test

Table 8.1 provides the test results of the air infiltration test.

Table 8.1: Air Infiltration Test Results

Specimen #	Test Pressure (psf)	Measured (cfm/ft^2)	Allowed (cfm/ft^2)
TS1(2)	+1.57	0.016	N/A
	+6.24	0.014	0.06
	+1.57	0.000	N/A
	+6.24	0.001	0.06

8.1.2 Conclusion – Air Infiltration Test

HTL observed a measured air infiltration less than the allowed air infiltration through the test specimen; as such, this test specimen satisfies the requirements of ASTM E330.

8.2 Water Infiltration Test

8.2.1 Results – Water Infiltration Test

Table 8.2 provides the results for the water infiltration test conducted per the requirements of ASTM E331 and TAS 202.

Table 8.2: Water Infiltration Test Results

Specimen #	Test Pressure (psf)	Spray Rate (gph/ft^2)	Test Duration (minutes)	Conclusion
TS1(2)	20	5.0	15	No Entry
	15	5.0	15	No Entry
	20	5.0	15	No Entry
	20	5.0	15	No Entry

8.2.2 Conclusion – Water Infiltration Test

HTL observed zero (0) water infiltration through the test specimen; as such, this test specimen satisfies the requirements of ASTM E331.

8.3 Dynamic Water Infiltration Test

8.3.1 Results – Dynamic Water Infiltration Test

Table 8.3 provides the results for the dynamic water infiltration test conducted per the requirements of AAMA 501.1.

Table 8.3: Dynamic Water Infiltration Test Results

Specimen #	Test Pressure (psf)	Measured	Allowed
TS1(2)	20	No Entry	No Entry

8.3.2 Conclusion – Dynamic Water Infiltration Test

HTL observed zero (0) water infiltration through the test specimen; as such, this test specimen satisfies the requirements of AAMA 501.1.

8.4 Interstory Displacement Test

8.4.1 Results – Interstory Displacement Test

Table 8.4 provides the results for the interstory displacement test conducted per the requirements of AAMA 501.4.

Table 8.4: Interstory Displacement Test Results

Specimen #	Displacement	# of Cycles	Conclusion
TS1(2)	+/-1.5"	3	PASS

8.4.2 Conclusion – Interstory Displacement Test

HTL observed no visible damage, no glass breakage/fallout, no wall components detached, and trim was not visibly disengaged; post displacement performance remained within specified

allowable limits without adjustments or repair; as such, this test specimen satisfies the requirements of AAMA 501.4.

8.5 Uniform Static Load Test

8.5.1 Deflection Gage Locations

Figure 8.1 shows the deflection gage locations for the uniform static load test.

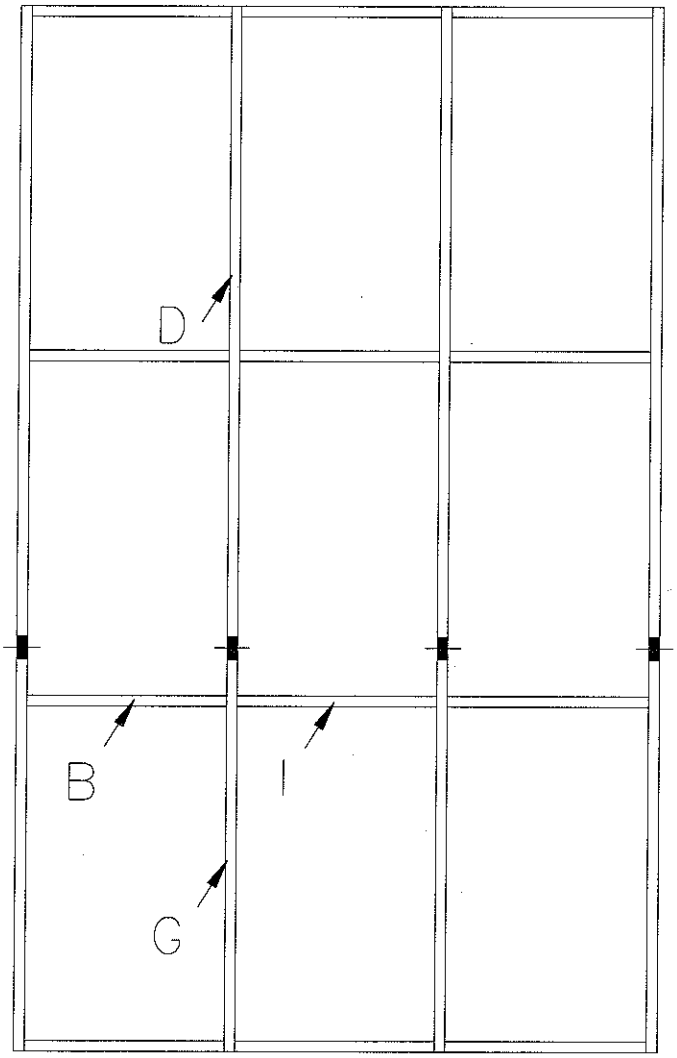


Figure 8.1: Deflection Gage Locations
Uniform Static Load Test

8.5.2 Positive Load Test Results

Table 8.5 provides the positive uniform static load test results for the deflection gage locations shown in Section 8.5.1. The deflection reported is the overall deflection between three points (longest unsupported span) which accounts for support movement.

Table 8.5: Positive Uniform Static Load Test Results

Specimen #	Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)	
			Measured	Allowed	Measured	Allowed
TS1(2)	B	+41.25	0.24	0.33	0.02	0.120
		+55.00	0.29	0.33	0.03	
		+82.50	0.04	N/A	0.00	
	D	+41.25	0.30	0.81	0.01	0.29
		+55.00	0.40	0.81	0.02	
		+82.50	0.62	N/A	0.03	
	G	+41.25	0.47	0.83	0.03	0.30
		+55.00	0.62	0.83	0.04	
		+82.50	0.93	N/A	0.05	
	I	+41.25	0.24	0.33	0.02	0.12
		+55.00	0.30	0.33	0.03	
		+82.50	0.05	N/A	0.00	

8.5.3 Negative Uniform Static Load Test Results

Table 8.6 provides the negative uniform static load test results for the locations presented in Section 8.5.1.

Table 8.6: Negative Uniform Static Load Test Results

Specimen #	Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)	
			Measured	Allowed	Measured	Allowed
TS1(2)	B	-41.25	0.09	0.33	0.08	0.12
		-55.00	0.11	0.33	0.08	
		-82.50	0.05	N/A	0.01	
	D	-41.25	0.27	0.81	0.01	0.29
		-55.00	0.38	0.81	0.02	
		-82.50	0.59	N/A	0.03	
	G	-41.25	0.45	0.83	0.05	0.30
		-55.00	0.62	0.83	0.07	
		-82.50	0.89	N/A	0.05	
	I	-41.25	0.03	0.33	0.00	0.12
		-55.00	0.04	0.33	0.00	
		-82.50	0.06	N/A	0.01	

8.5.4 Conclusion – Uniform Static Load Test

HTL observed no signs of failure in any area of this test specimen during the uniform static load test. In addition, this specimen met the deflection and permanent set requirements; as such, this test specimen satisfies the uniform static load test requirements of ASTM E330.

9.0 SUMMARY

Table 9.1 provides a summary of the test results for YKK AP America's YHC 300.

Table 9.1: Summary of Test Results

Specimen #	Test Method	Test Conditions	Test Conclusion
TS1(2)	Air Infiltration Test (ASTM E283)	1.57 & 6.24 psf	PASS
TS1(2)	Water Infiltration Test (ASTM E331)	20 psf	PASS
TS1(2)	Dynamic Water Infiltration Test (AAMA 501.1)	20 psf	PASS
TS1(2)	Interstory Displacement Test (AAMA 501.4)	+/-1.5"	PASS (Seismic Use Group III)
TS1(2)	Air Infiltration Test (ASTM E283)	1.57 & 6.24 psf	PASS
TS1(2)	Water Infiltration Test (ASTM E331)	15 psf	PASS
TS1(2)	Water Infiltration Test (ASTM E331)	20 psf	PASS
TS1(2)	Water Infiltration Test (ASTM E331)	20 psf	PASS
TS1(2)	Static Load Test (ASTM E330)	+/- 55 psf Design Pressure	PASS

10.0 CERTIFICATION AND DISCLAIMER STATEMENT

All tests performed on this test specimen were conducted in accordance with the specifications of the applicable codes, standards and test methods listed below by HTL, LLC. HTL, LLC does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested at HTL. HTL is not owned, operated or controlled by any company manufacturing or distributing products it tests. This report is only intended for the use of the entity named in Section 1.0 of this report. Detailed assembly drawings showing wall thickness of all members, corner construction and hardware applications are on file and have been compared to the test specimen submitted. A copy of this test report along with representative sections of the test specimen will be retained at HTL for a period of three (3) years. All results obtained apply only to the specimen tested and they do indicate compliance with the performance requirements of the test methods and specifications listed in the following section.

ENGINEER OF RECORD

11/3/09

REPORT WRITER

11/3/09

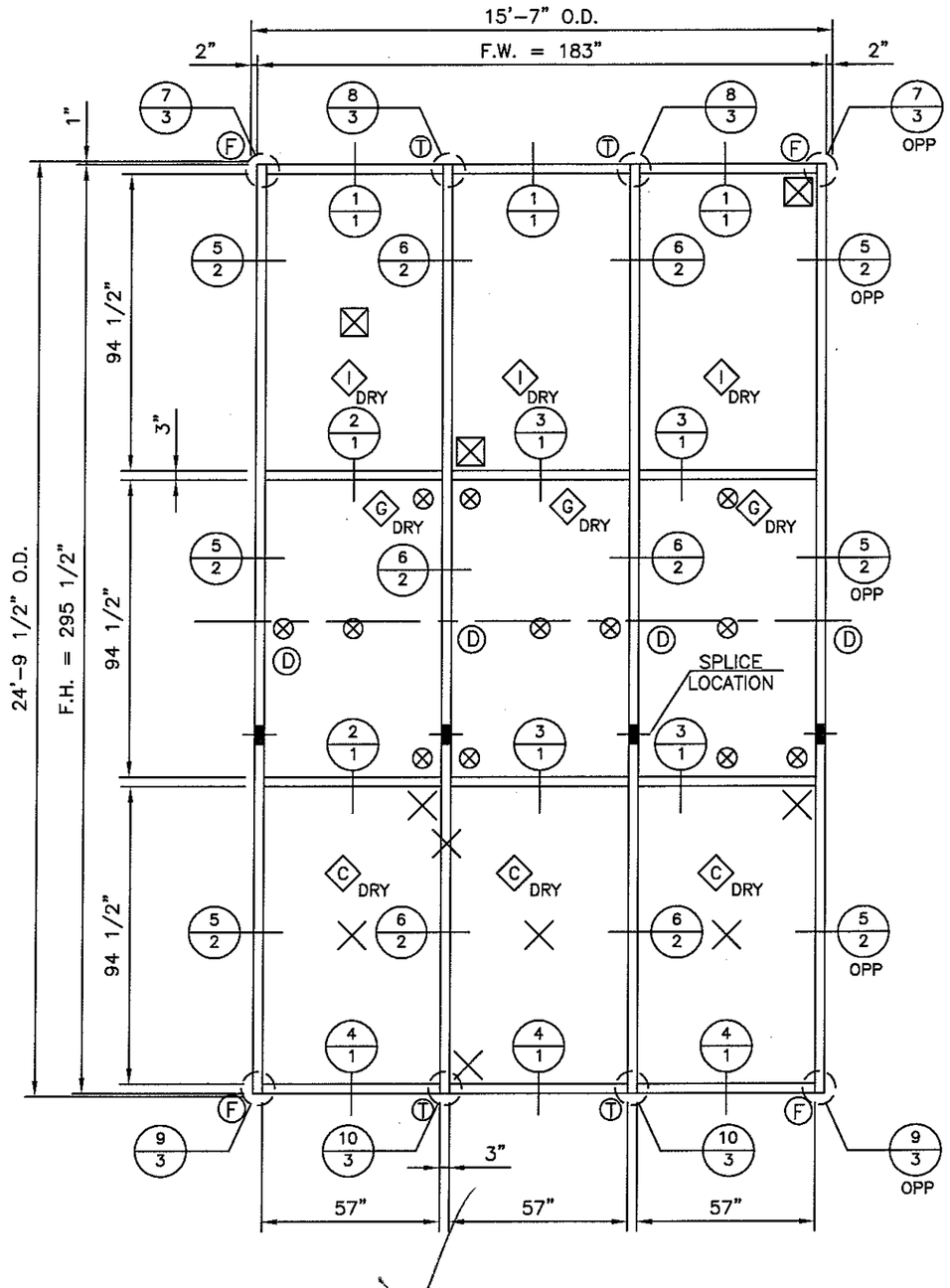
11.0 APPLICABLE CODES, STANDARDS, AND TEST METHODS

ASTM E283-04 – Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330-02 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331-00 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
AAMA 501.1-05 – Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
AAMA 501.4-00 – Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts

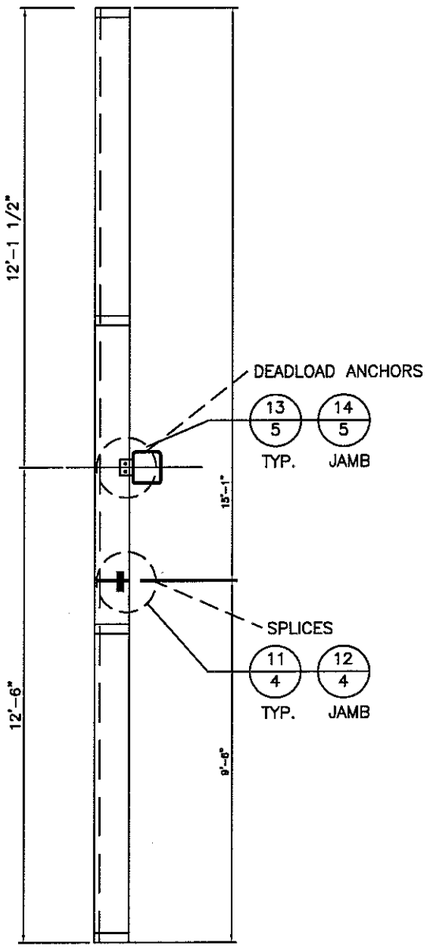
12.0 WITNESSES (ALL OR PARTIAL)

Vinu J. Abraham, P.E.	CEO	HTL, LLC
Kristin Norville, E.I.	Assistant Operations Manager	HTL, LLC
John Spallina	Technician	HTL, LLC
Howard Bennett	Technician	HTL, LLC
Veron Wickham	Technician	HTL, LLC
Martin Gibbard	Technician	HTL, LLC
Alan Rule	Technician	HTL, LLC
Freddie Henderson	Technician	HTL, LLC

REV.	DESCRIPTION	BY	DATE



ELEVATION TWIN SPAN 1
(1) req'd
SCALE 1/4" = 1'-0"



GLASS TYPE

C — 9/16" SENTRYGLASS: (LARGE MISSILE) (DRY GLAZED)
1/4" HEAT STRENGTHENED GLASS + 0.060" SENTRYGLASS +
1/4" HEAT STRENGTHENED GLASS

G — 9/16" 0.060 BUTACITE: (SMALL MISSILE) (DRY GLAZED)
1/4" HEAT STRENGTHENED GLASS + 0.060" BUTACITE (PVB) +
1/4" HEAT STRENGTHENED GLASS

I — 9/16" 0.035 SENTRYGLASS: (SMALL MISSILE) (DRY GLAZED)
1/4" HEAT STRENGTHENED GLASS + 0.035" SENTRYGLASS +
1/4" HEAT STRENGTHENED GLASS

NOTES:
1. INSTALLED INTO STEEL STRUCTURE
2. DESIGN PRESSURE LOAD = 55psf
3. TEST TO PERFORM = TAS-202-94
TAS-201-94
TAS-203-94

IMPACT LOCATION LEGEND

X LARGE MISSILE IMPACT LOCATION
⊗ SMALL MISSILE IMPACT LOCATION
☒ LEVEL C LARGE MISSILE IMPACT LOCATION

ANCHOR TYPE

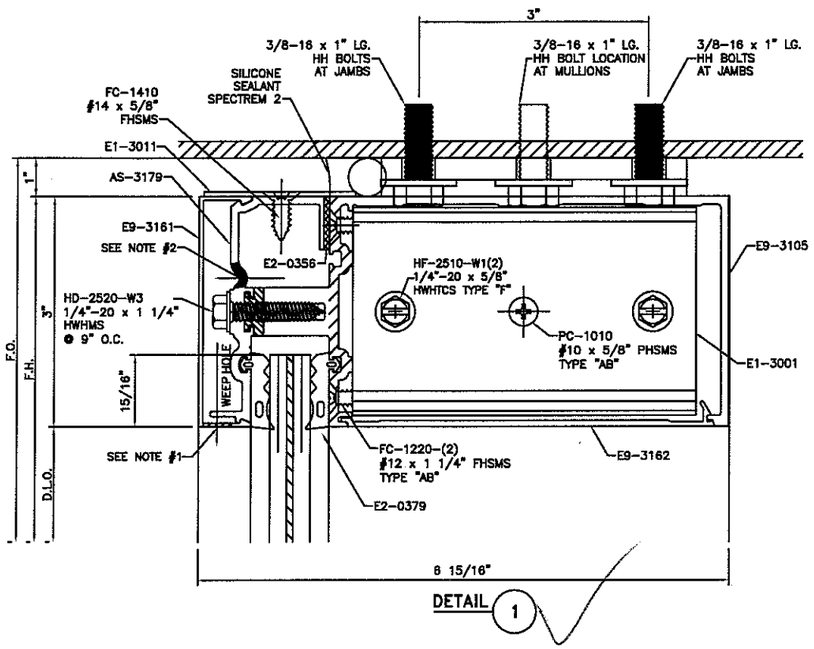
(D): D/L ANCHOR
(F): 'F' ANCHOR
(T): 'T' ANCHOR

HTL
AS TESTED UNLESS OTHERWISE NOTED
DATE 11-2-2009
JOB# 0231-0807-09

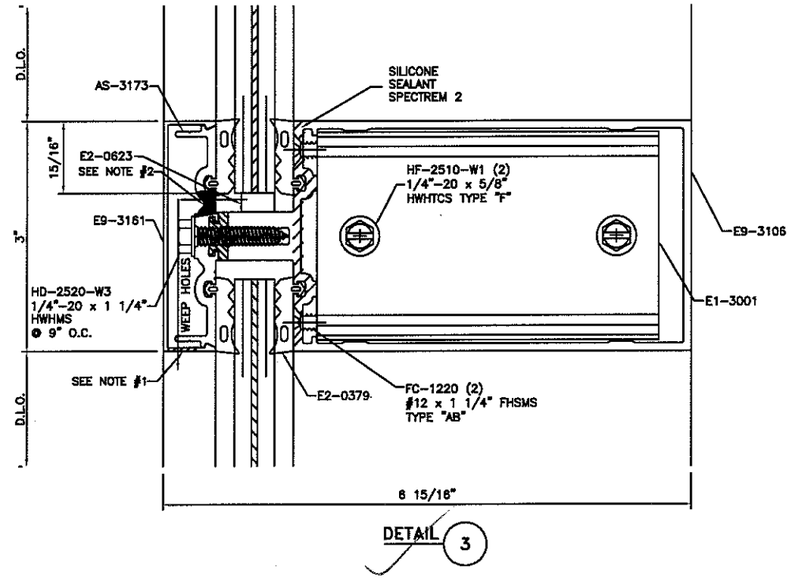
YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: AS NOTED
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: ELEV-TS1	
APPROVED BY: RB / DRAWN BY: DO / DATE: 06/17/09	SHEET NO: TS1

REV.	DESCRIPTION	BY	DATE



DETAIL 1



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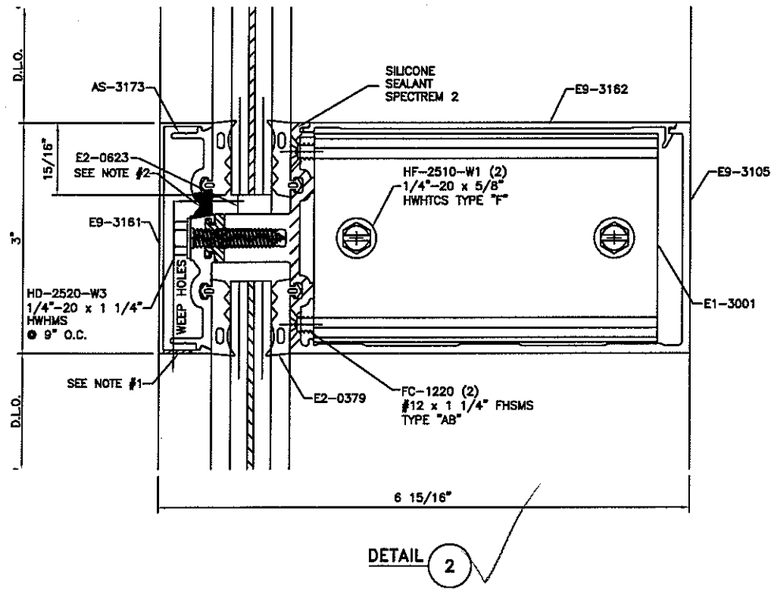

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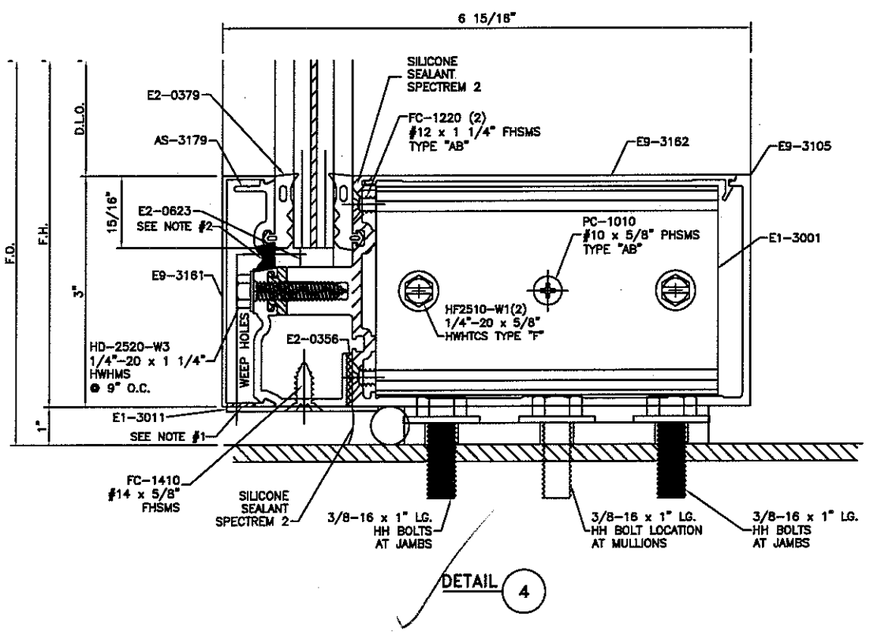


DETAIL 4

NOTES:

1. 5/16" DIA. WEEP HOLE (2) PER HORIZONTAL COVER LOCATED @ 1/3 POINTS
2. 5/16" DIA. WEEP HOLE (3) PER HORIZONTAL, 3" FROM EACH END, & ONE IN THE CENTER.

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 11-2-2009

JOB# 0231-0807-09

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-TS1	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/22/09	1

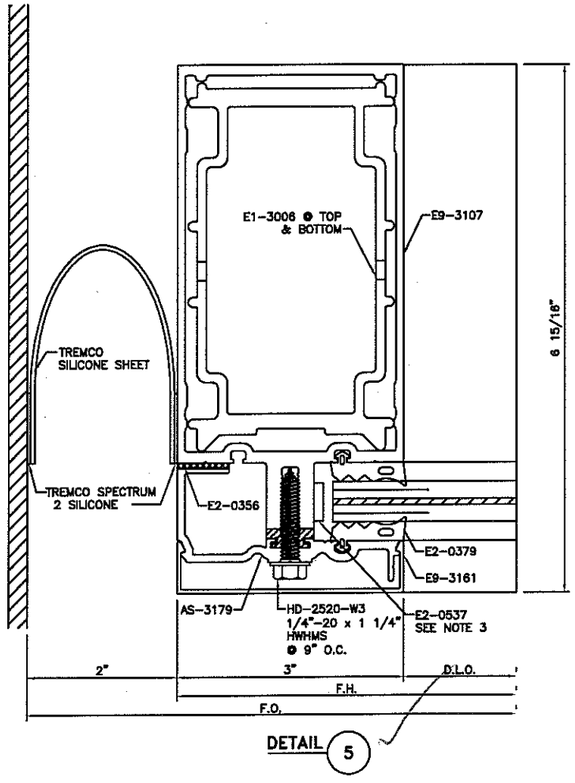
REV.	DESCRIPTION	BY	DATE

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# 0231-0807-09



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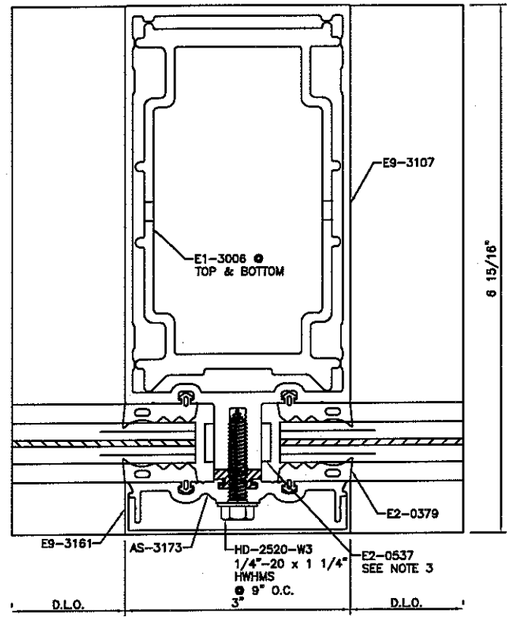


DETAIL 6

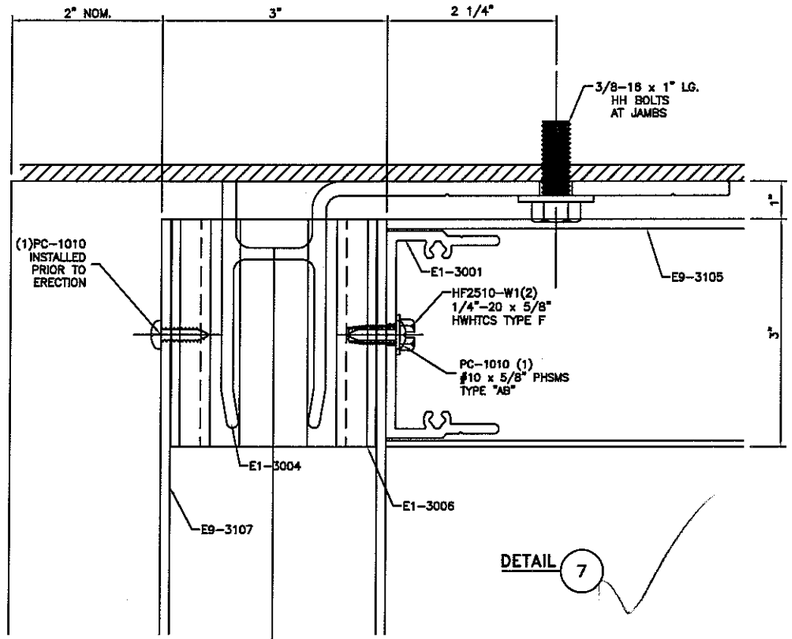
NOTE 3: SIDE BLOCK E2-0537 @ QUARTER POINTS

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: HALF
	GLAZING
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-TS1	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/22/09	2

REV.	DESCRIPTION	BY	DATE



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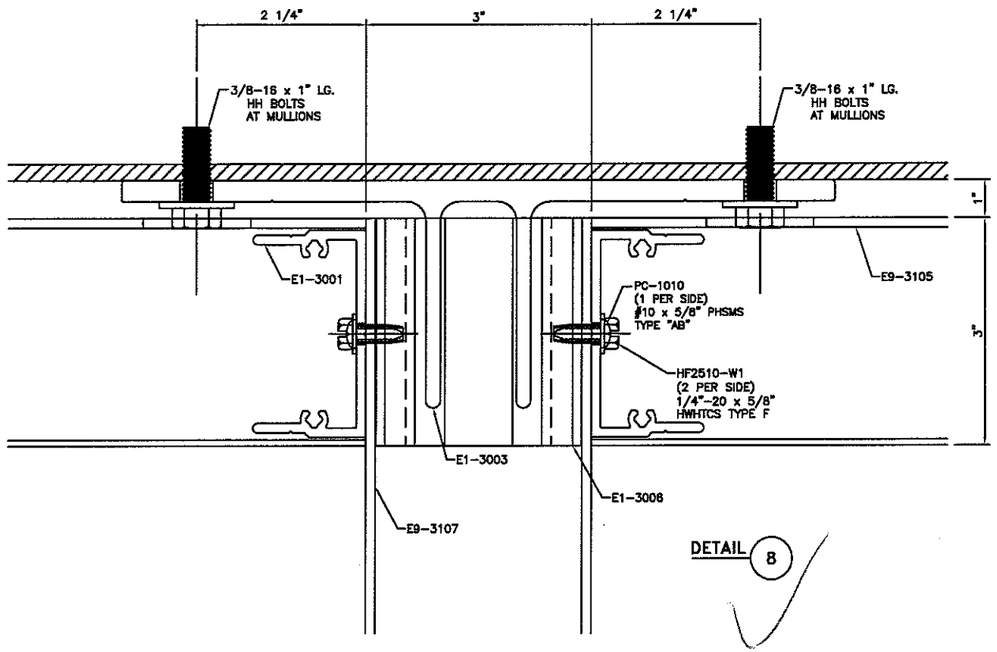

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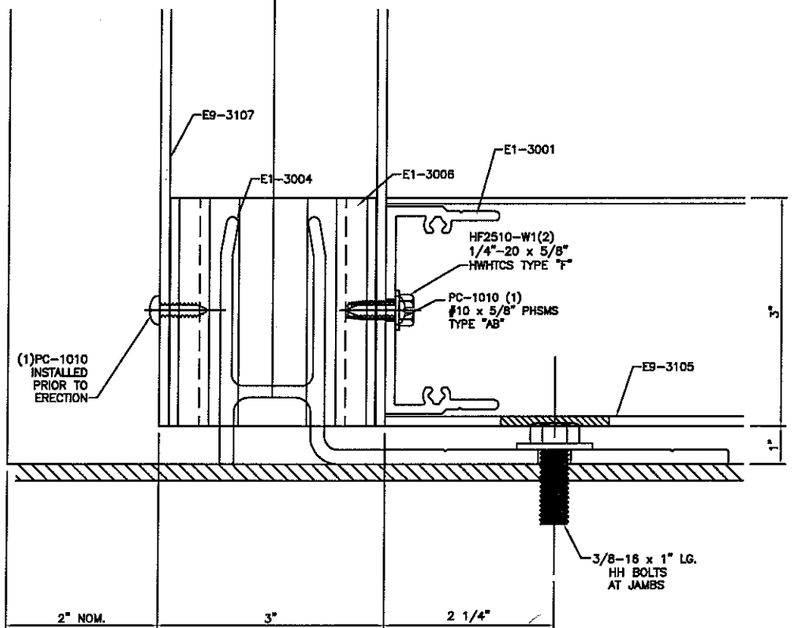

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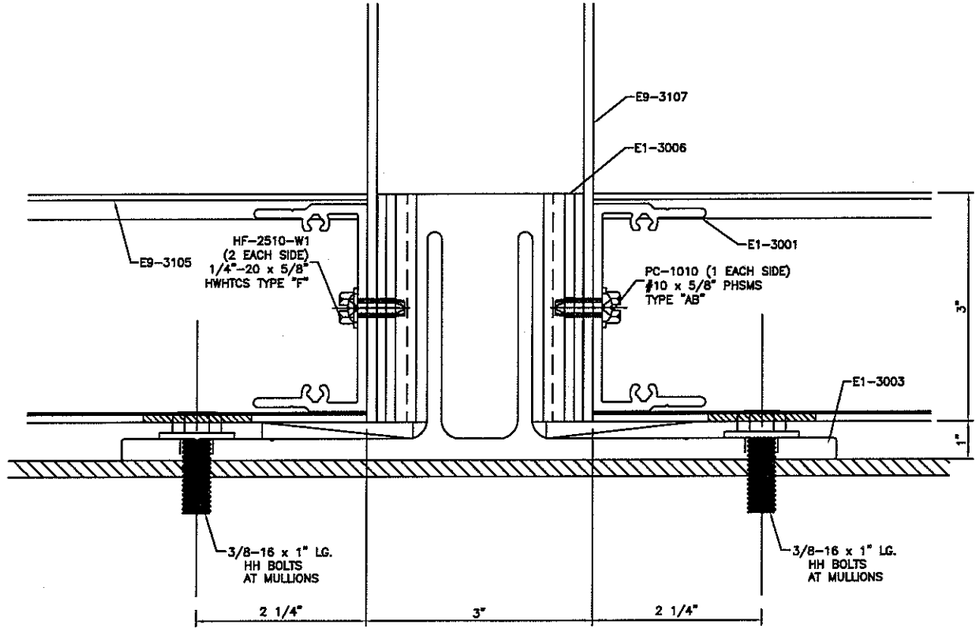


DETAIL 10

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 11-2-2009

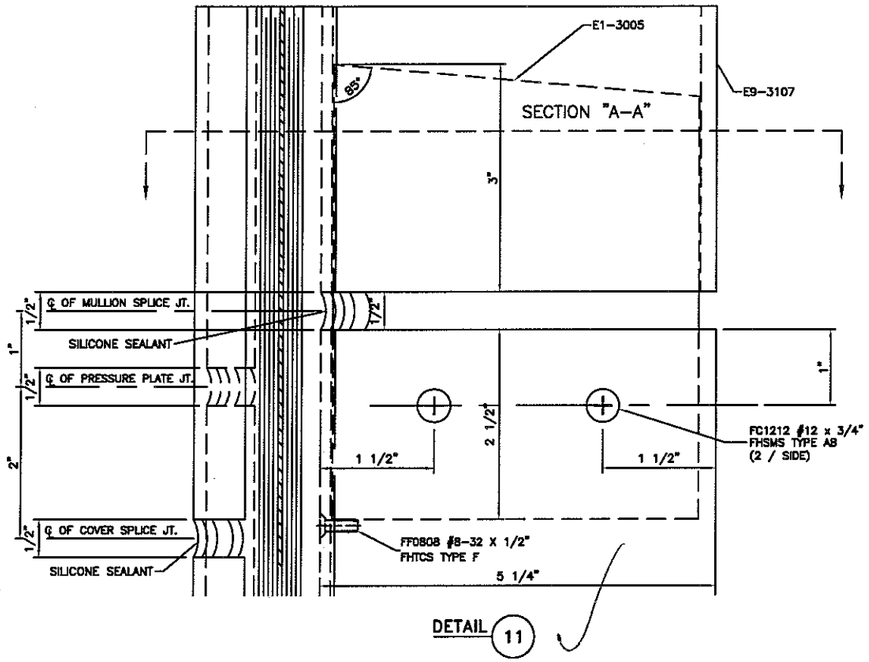
JOB# 0231-0807-09

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-TS1	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/22/09	3

REV.	DESCRIPTION	BY	DATE



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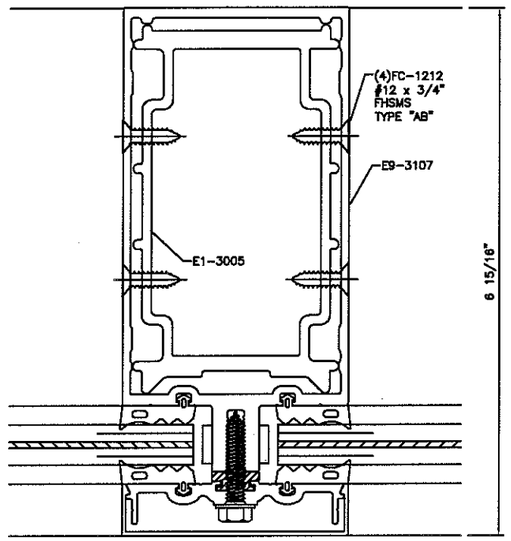

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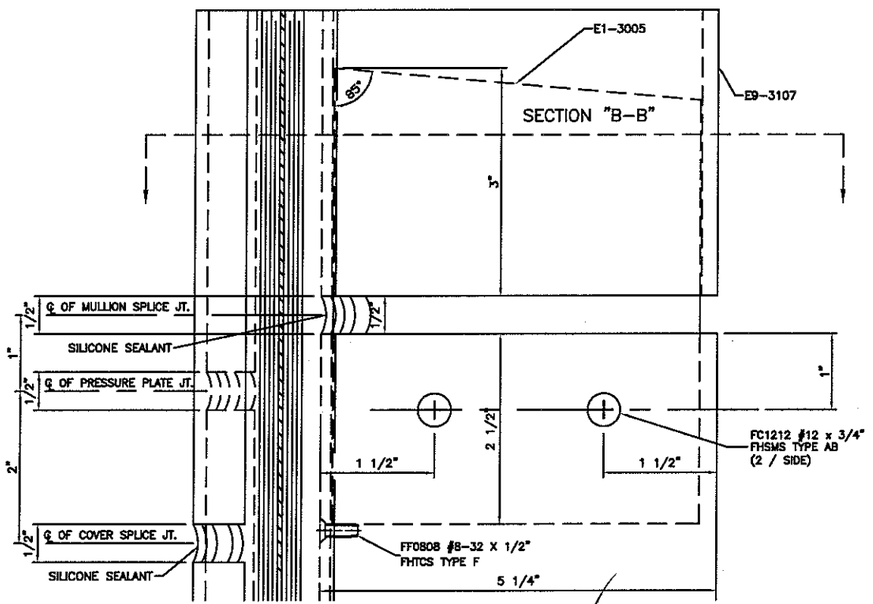

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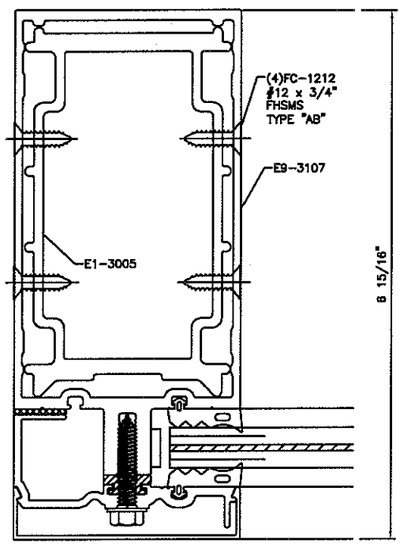


SECTION "B-B"

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

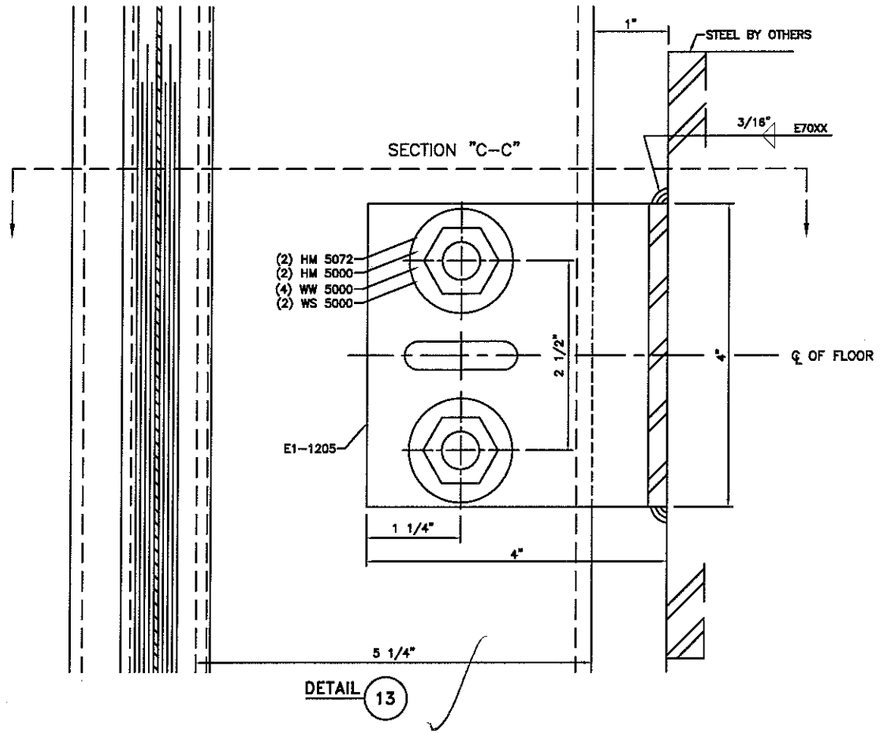
JOB# 0231-0807-09

YKK ap

SYSTEM: YHC 300 D.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-TS1	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/22/09	4

REV.	DESCRIPTION	BY	DATE



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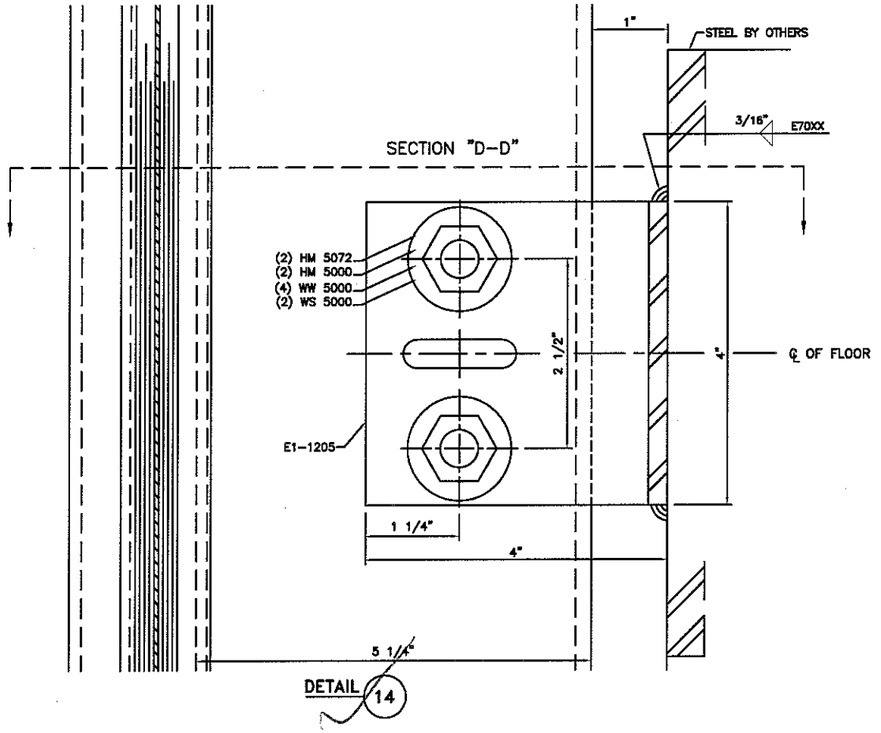

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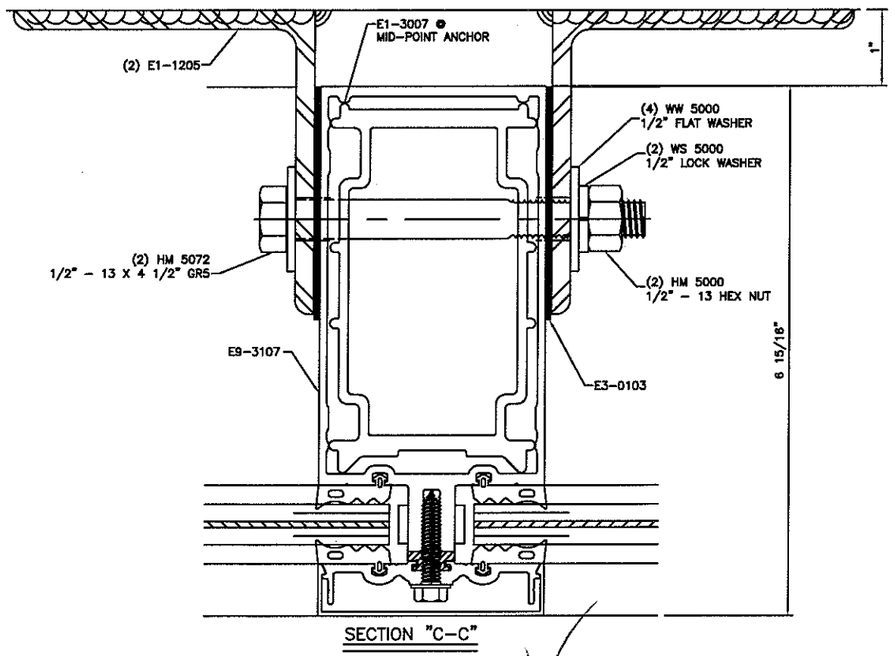

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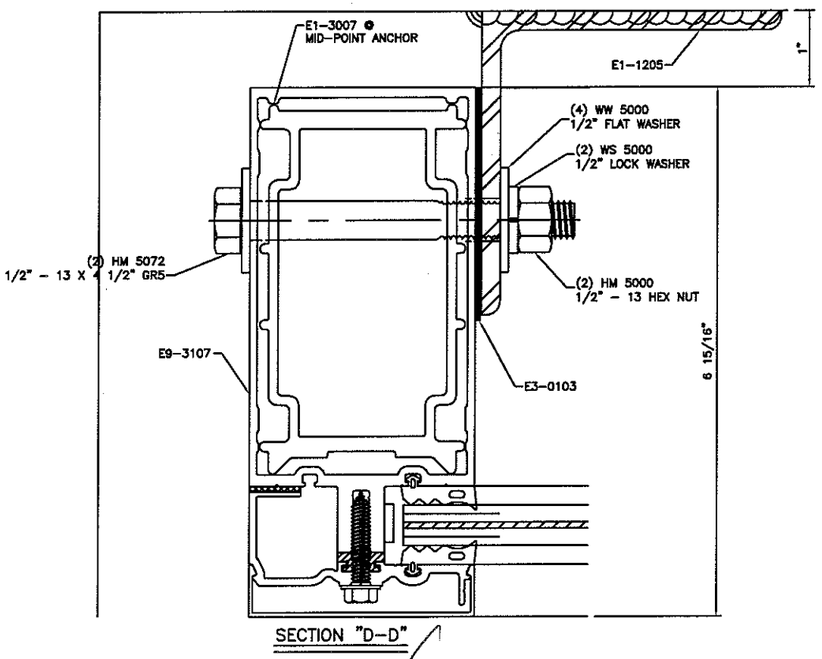


SECTION "D-D"

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# 0231-0807-09

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT		SCALE: HALF
		GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST		
FINISH: PAINTED		
DRAWING NUMBER: DET-TS1		
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/22/09
		SHEET NO. 5

FLORIDA | GEORGIA | TEXAS
CORPORATE HEADQUARTERS
6655 Garden Road
Riviera Beach, FL 33404
(561)-881-0020
HTLTEST.COM

YKK AP AMERICA, INC.

Curtainwall
Test Report #: 0231-0807-09 & G231-1001-09

1.0 MANUFACTURER'S IDENTIFICATION

1.1	Name of Applicant:	YKK AP AMERICA, INC. 7680 The Bluffs, Suite 100 Austell, GA 30168 Voice: (678) 838-6095 Fax: (678) 838-6056
1.2	Contact Person:	Don Pangburn

2.0 LABORATORY IDENTIFICATION

2.1	HTL Test Notification:	HTL09061 & HTLGA0928
2.2	HTL Lab Certifications:	Miami-Dade County (05-1014.01); Florida Building Code (TST1527); IAS (TL-244); AAMA; WDMA; Keystone Certificate; Texas Department of Insurance

3.0 SCOPE OF WORK

3.1 Introduction

YKK AP AMERICA, INC. retained HTL, LLC to conduct Florida Building Code standard testing on their YHC 300 O.G. Curtainwall system.

3.2 Report Information

Table 3.1 provides the test dates for each mock-up and specimen number.

Table 3.1: Specimen Test Dates

Mock-Up	Specimen #	Test Date
TS1	2	9/29/09 – 10/22/09
2A	2A	10/22/09 – 10/23/09

4.0 PRODUCT IDENTIFICATION

4.1	Product Type:	Curtainwall
4.2	Model Designation:	YHC 300 O.G.
4.3	Performance Class:	+/-55 psf Design Pressure

VINU J. ABRAHAM LICENSE ENGINEER OF RECORD No. 53820 PROFESSIONAL ENGINEER STATE OF FLORIDA

Vinu J. Abraham, P.E.
FL Reg. #53820
11/3/09

REPORT WRITER

Angela Abramczyk

11/3/09

4.4 Overall Size & Configuration: Table 4.1 provides the overall size for each mock-up/specimen number. The table also indicates which YKK AP AMERICA, INC. drawing number and sheet to see for the configuration of each mock-up.

Table 4.1: Specimen Overall Size

Mock-Up	Specimen #	Overall Size	Drawing/Sheet #
Elevation TS1 (2)	2	183" (w) x 295-1/2" (h)	ELEV-TS1/TS1
Elevation 2A	2A	183" (w) x 126" (h)	ELEV-2A/2A

4.5 Number of Operable Panels: None

4.6 Drawing: This test report is incomplete if not accompanied by the YKK AP AMERICA, INC. drawing numbers indicated in Table 4.2. bearing the ink stamp of Hurricane Test Laboratory, LLC.

Table 4.2: Drawing Numbers

Elevation #	Drawing #	Sheets
TS1 (2)	ELEV-TS1	TS1
TS1 (2)	DET-TS1	1 - 5
2A	ELEV-2A	2A
2A	DET-2A	1 - 4

4.7 Sample Source: Samples provided by YKK AP AMERICA, INC.

5.0 PRODUCT DESCRIPTION

5.1 Frame Construction

The framing members were fabricated using the aluminum extrusions defined in Table 5.1.

Table 5.1: Aluminum Extrusion Details

Description	Part #	Overall Cross-Section	Alloy/Temper
Elevation TS1 (2)			
Head & Sill	E9-3105	6.110" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (left bay)	E9-3105	6.110" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (all other areas)	E9-3106	6.110" x 3.000" x 0.100"	6063-T5
Mullion	E9-3107	3.000" x 6.120" x 0.100"	6063-T6
Flush Filler (for E9-3105)	E9-3162	4.890" x 0.331" x 0.079"	6063-T5
Elevation 2A			
Head & Sill	E9-3104	6.678" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (left bay)	E9-3104	6.678" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (all other areas)	E9-3102	6.678" x 3.000" x 0.100"	6063-T5
Mullion	E9-3111	3.000" x 6.688" x 0.100"	6063-T6
Flush Filler (for E9-3104)	E9-3162	4.890" x 0.331" x 0.079"	6063-T5

5.1.1 Typical Frame Corner Construction

At each corner, the vertical frame member ran through while the horizontal frame member end was square cut, butted and mechanically fastened to the vertical frame member via a 4-1/2" (long) aluminum shear block (Part #E1-3001). At each frame corner, the shear block was attached to the vertical frame member using two (2), ¼"-20 x 5/8" HWH TCS (Type F). Each horizontal frame member end was attached to the adjacent shear block using two (2), #12 x 1-1/4" FH SMS (Type AB).

5.1.2 Frame Joint Sealant

At each frame joint, the exterior leg of each horizontal frame member was sealed with a bead of Tremco® Spectrem 2® silicone sealant prior to its attachment to the shear block.

5.1.3 End Cap & Anchor Sleeve Construction

There was a mullion end cap (Part # E1-3011 for Elevation TS1 (2) & E1-3010 for Elevation 2A) attached to the top and bottom end of each mullion and jamb using one (1), #14 x 5/8" FH SMS. NOTE: One (1), 3" long anchor sleeve (Part #E1-3006) was inserted into the top and bottom of each mullion end and secured in place using two (2), #10 x 5/8" PH SMS (Type AB).

5.1.4 Miscellaneous Construction

There was a continuous filler (Part # E9-3162) used at the interior frame head, sill and some intermediate horizontal (see above Table 5.1 "Aluminum Extrusion Details" for where the intermediate horizontals would apply) locations between each mullion.

5.2 Pressure Plate and Snap Cover Assembly

Table 5.2 provides the extrusions used in the pressure plate and snap cover assemblies.

Table 5.2: Pressure Plate and Snap Cover Details

Description	Part #	Overall Cross-Section	Alloy/Temper
Elevation TS1 (2)			
Perimeter Pressure Plate	E9-3179	2.955" x 1.489" x 0.100"	6063-T5
Intermediate Horizontal/Vertical Pressure Plate	E9-3173	2.910" x 0.566" x 0.115"	6063-T5
Snap Cover	E9-3161	3.000" x 0.687" x 0.056"	6063-T5
Elevation 2A			
Perimeter Pressure Plate	E9-3178	2.955" x 1.976" x 0.100"	6063-T5
Intermediate Horizontal/Vertical Pressure Plate	E9-3172	2.910" x 0.743" x 0.115"	6063-T5
Snap Cover	E9-3161	3.000" x 0.687" x 0.056"	6063-T5

5.2.1 Pressure Plates

Each continuous pressure plate (Part # E9-3178, E9-3179, E9-3172 or E9-3173) was square cut at each end and secured to the adjacent frame member using a single row of ¼"-20 x 1-1/4" HWH MS spaced 1-1/2" from each end and at 9" on center thereafter. NOTE: A continuous EPDM thermal isolator (Part # E2-0103) was applied to the centerline of each pressure plate prior to its installation. A continuous strip of 0.125" x 0.688" sponge isolator tape (Part # E2-0356) was applied to the perimeter leg of each perimeter pressure plate prior to its installation. The

"AS" part #s called out in the details are the assembled pressure plates with this EPDM thermal isolator and (if applicable) the sponge isolator tape applied to the perimeter pressure plate. YKK AP AMERICA, INC. does not produce separate drawings for "AS" part numbers.

5.2.2 Snap Covers
At the exterior of all pressure plates, the snap covers (Part # E9-3161) were snap fit to the pressure plate.

5.3 Splice Construction (Elevation TS1 [2])
The vertical members used in this test specimen consisted of two separate sections, i.e., a 114" long lower section and a 181" long upper section. The lower and upper sections of the vertical members were each spliced together using a 6" long splice sleeve (Part # E1-3005). At each splice location, first a #8-32 x ½" FH TCS (Type F) was secured to the lower section, then the splice sleeve was inserted into the lower section and allowed to rest on top of this fastener. Finally, two (2), #12 x ¾" FH SMS (Type AB) were applied to each side of the vertical, passed through the lower section and threaded into the splice sleeve.

5.4 Vertical Reinforcement (Elevation TS1 [2])
The vertical members were reinforced at the mid-point of the dead load anchor locations using the part defined in Table 5.3.

Table 5.3: Vertical Reinforcement Details

Description	Part #	Overall Cross-Section	Material
Vertical Reinforcement Sleeve	E1-3007	2.734" x 4.860" x 0.125"	6063-T5

5.4.1 Vertical Reinforcement Sleeve
Each 29" long vertical reinforcement sleeve (Part # E1-3007) was attached to the adjacent vertical member via the dead load anchor fasteners.

5.5 Glazing Details
5.5.1 Glass Type C consisted of 9/16" thick (nominal) laminated glass consisting of the following components:
- ¼" heat strengthened glass
- 0.060" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

Glass Type G consisted of 9/16" thick (nominal) laminated glass consisting of the following components:
- ¼" heat strengthened glass
- 0.060" DuPont Butacite® PVB Interlayer (Miami-Dade NOA #05-1208.02)
- ¼" heat strengthened glass

Glass Type I consisted of 9/16" thick (nominal) laminated glass consisting of the following components:
- ¼" heat strengthened glass
- 0.035" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

Glass Type CI consisted of 1-5/16" thick (nominal) insulated laminated glass consisting of the following components:
- ¼" tempered glass
- ½" air space
- ¼" heat strengthened glass
- 0.060" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

Glass Type GI consisted of 1-5/16" thick (nominal) insulated laminated glass consisting of the following components:
- ¼" tempered glass
- ½" air space
- ¼" heat strengthened glass
- 0.060" DuPont Butacite® PVB Interlayer (Miami-Dade NOA #05-1208.02)
- ¼" heat strengthened glass

Glass Type II consisted of 1-5/16" thick (nominal) insulated laminated glass consisting of the following components:
- ¼" tempered glass
- ½" air space
- ¼" heat strengthened glass
- 0.035" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

5.5.2 Glazing Method

The glass lites used in these test specimens were exterior glazed on both the interior and the exterior side using strips of EPDM gasket (Part # E2-0379).

5.5.3 Daylight Opening and Glass Bite

The glass types for each lite were per the YKK AP AMERICA, INC. drawing numbers and sheets indicated in Table 5.4, without modifications.

Table 5.4: Daylight Opening and Glass Bite Details

Elevation #	Qty.	Daylight Opening	Glass Bite	Drawing #	Sheet #
TS1 (2)	9	57" (w) x 94-1/2" (h)	15/16"	ELEV-TS1	TS1
2A	3	57" (w) x 22-1/2" (h)	15/16"	ELEV-2A	2A
	3	57" (w) x 94-1/2" (h)	15/16"	ELEV-2A	2A

5.6 Weather Stripping

None used

5.7 Hardware

None used

5.8 Weep Holes, Water Diverters, and Covers

Table 5.5 provides the weep holes used in these test specimens.

Table 5.5: Weep Hole Details

Qty.	Location	Description
2/snap cover	At the third points of each exterior horizontal snap cover	5/16" diameter weep hole
3/member	3" from each end and at the centerline of each horizontal frame member	5/16" diameter weep hole

5.9 Sealants Used

Table 5.6 provides a summary of the sealants used in each test specimen.

Table 5.6: Sealant Details

Elevation #	Location	Sealant Description
TS1 (2) – head & sill	Perimeter Sealant	Tremco® Spectrem 2® silicone sealant
TS1 (2) – jambs	Perimeter Sealant	Silicone sheet
2A	Perimeter Sealant	Tremco® Spectrem 2® silicone sealant
TS1 (2) & 2A	Frame Joint Sealant	Tremco® Spectrem 2® silicone sealant
N/A	Glazing Sealant	None used

6.0 PRODUCT INSTALLATION

Table 6.1 provides a detailed summary of the product installation into the steel opening. The rough opening allowed for a 2" shim space at the jambs of Elevation TS1 (2). The rough opening allowed for a 1" shim space in all other areas.

Table 6.1: Product Installation Details

Elevation #	Location	Description	Installation	
			Test Opening	Frame member
TS1 (2)	Jambs	"F" anchor (Part # E1-3004)	Two (2), 3/8-16 x 1" HH bolts	Slide in
TS1 (2)	Intermediate Mullions	"T" anchor (Part # E1-3003)	Two (2), 3/8-16 x 1" HH bolts	Slide in
TS1 (2)	Jambs @ 150" from sill	Dead load anchor (Part # E1-1205)	3/16" long fillet weld along the top and bottom edges of the angle leg that was against the opening	Two (2), 1/2"-13 x 4-1/2" Grade 5 bolts w/matching nuts and washers
TS1 (2)	Intermediate Mullions @ 150" from sill	Two (2) dead load anchors (Part # E1-1205)	3/16" long fillet weld along the top and bottom edges of the angle legs that were against the opening	Two (2), 1/2"-13 x 4-1/2" Grade 5 bolts w/matching nuts and washers
2A	Jambs	"F" anchor (Part # E1-3004)	Two (2), 3/8-16 x 1" HH bolts	Slide in
2A	Intermediate Mullions	"T" anchor (Part # E1-3003)	Two (2), 3/8-16 x 1" HH bolts	Slide in

NOTE: Each dead load anchor was installed with a nylon slip pad (Part # E3-0103) between it and the steel substrate. At all dead load anchor locations the bolts pass through the reinforcement sleeve.

7.0 TEST SEQUENCE

Table 7.1 provides a summary of the test sequence for each test specimen tested.

Table 7.1: Test Sequence

Test Specimen TS1(2)	Test Specimen 2A
1. Air Infiltration Test	1. Positive Pre-Load
2. Positive Pre-Load	2. Positive Design Load
3. Positive Design Load	3. Positive Overload
4. Negative Pre-Load	4. Negative Pre-Load
5. Negative Design Load	5. Negative Design Load
6. Water Infiltration Test	6. Negative Overload
7. Positive Overload	7. Large Missile Impact
8. Negative Overload	8. Small Missile Impact
9. Large Missile Impact Level C	9. Positive Cyclic Load
10. Large Missile Impact Level D	10. Negative Cyclic Load
11. Small Missile Impact	
12. Positive Cyclic Load	
13. Negative Cyclic Load	
14. Large Missile Impact Level C	

8.0 TEST RESULTS

8.1 Air Infiltration Test

8.1.1 Results – Air Infiltration Test

Table 8.1 provides the test results of the air infiltration test.

Table 8.1: Air Infiltration Test Results

Specimen #	Test Pressure (psf)	Measured (cfm/ft^2)	Allowed (cfm/ft^2)
TS1(2)	+1.57	0.016	N/A
	+6.24	0.014	0.06

8.1.2 Conclusion – Air Infiltration Test

HTL observed a measured air infiltration less than the allowed air infiltration through the test specimen; as such, this test specimen satisfies the requirements of ASTM E330.

8.2 Water Infiltration Test

8.2.1 Results – Water Infiltration Test

Table 8.2 provides the results for the water infiltration test conducted per the requirements of ASTM E331.

Table 8.2: Water Infiltration Test Results

Specimen #	Test Pressure (psf)	Spray Rate (gph/ft^2)	Test Duration (minutes)	Conclusion
TS1(2)	20	5.0	15	No Entry

8.2.2 Conclusion – Water Infiltration Test

HTL observed zero (0) water infiltration through the test specimen; as such, this test specimen satisfies the requirements of ASTM E331.

8.3 Uniform Static Load Test

8.3.1 Deflection Gage Locations

Figures 8.1 and 8.2 show the deflection gage locations for the uniform static load test.

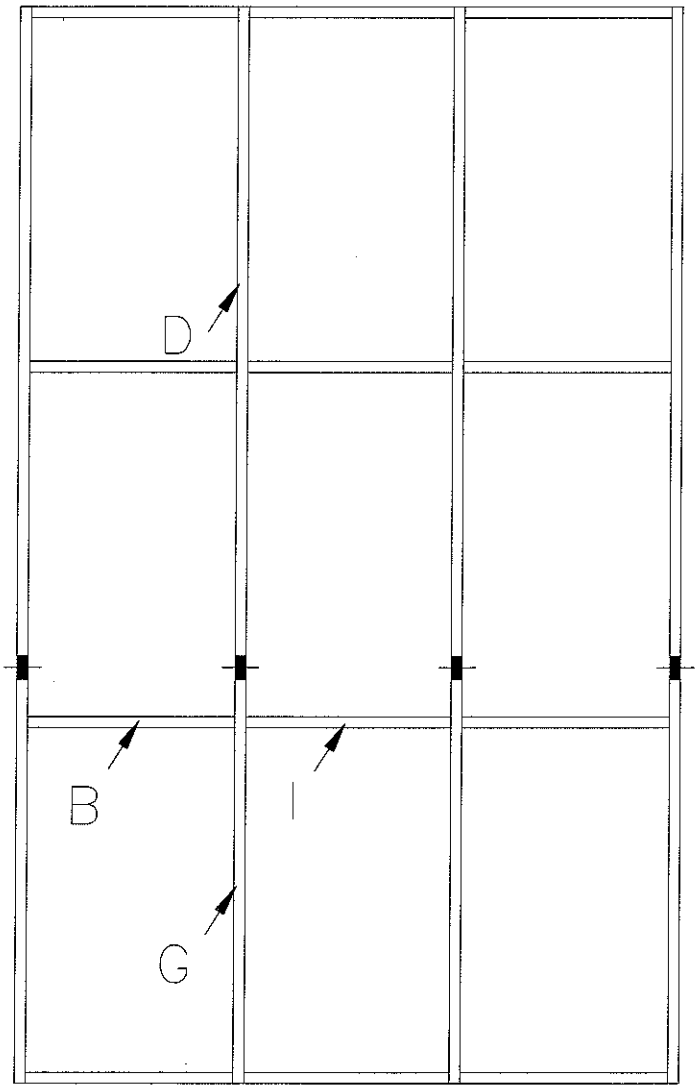


Figure 8.1: Deflection Gage Locations
Uniform Static Load Test - Specimen TS1(2)

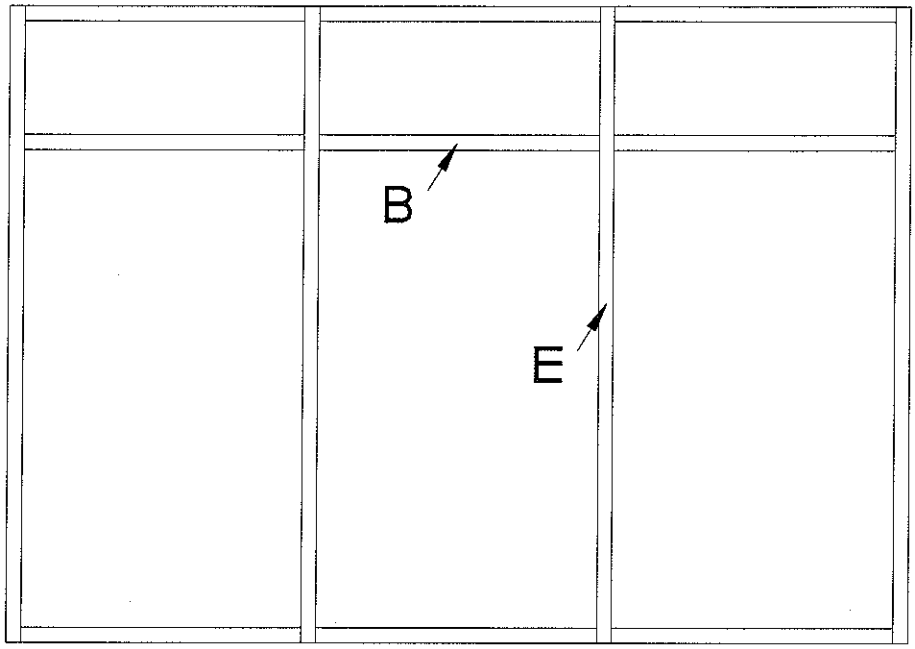


Figure 8.2: Deflection Gage Locations
Uniform Static Load Test - Specimen 2A

8.3.2 Positive Load Test Results

Table 8.3 provides the positive uniform static load test results for the deflection gage locations shown in Section 8.3.1. The deflection reported is the overall deflection between three points (longest unsupported span) which accounts for support movement.

Table 8.3: Positive Uniform Static Load Test Results

Specimen #	Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)	
			Measured	Allowed	Measured	Allowed
TS1(2)	B	+41.25	0.24	0.33	0.02	0.120
		+55.00	0.29	0.33	0.03	
		+82.50	0.04	N/A	0.00	
	D	+41.25	0.30	0.81	0.01	0.29
		+55.00	0.40	0.81	0.02	
		+82.50	0.62	N/A	0.03	
	G	+41.25	0.47	0.83	0.03	0.30
		+55.00	0.62	0.83	0.04	
		+82.50	0.93	N/A	0.05	
	I	+41.25	0.24	0.33	0.02	0.12
		+55.00	0.30	0.33	0.03	
		+82.50	0.05	N/A	0.00	

Specimen #	Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)	
			Measured	Allowed	Measured	Allowed
2A	B	+41.25	0.00	N/A	0.00	0.12
		+55.00	0.03	0.33	0.00	
		+82.50	0.02	N/A	0.01	
	E	+41.25	0.35	N/A	0.01	0.25
		+55.00	0.48	0.70	0.01	
		+82.50	0.76	N/A	0.02	

8.3.3 Negative Uniform Static Load Test Results

Table 8.4 provides the negative uniform static load test results for the locations presented in Section 8.3.1.

Table 8.4: Negative Uniform Static Load Test Results

Specimen #	Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)	
			Measured	Allowed	Measured	Allowed
TS1(2)	B	-41.25	0.09	0.33	0.08	0.12
		-55.00	0.11	0.33	0.08	
		-82.50	0.05	N/A	0.01	
	D	-41.25	0.27	0.81	0.01	0.29
		-55.00	0.38	0.81	0.02	
		-82.50	0.59	N/A	0.03	
	G	-41.25	0.45	0.83	0.05	0.30
		-55.00	0.62	0.83	0.07	
		-82.50	0.89	N/A	0.05	
	I	-41.25	0.03	0.33	0.00	0.12
		-55.00	0.04	0.33	0.00	
		-82.50	0.06	N/A	0.01	
2A	B	-41.25	0.02	N/A	0.01	0.12
		-55.00	0.14	0.33	0.02	
		-82.50	0.05	N/A	0.03	
	E	-41.25	0.36	N/A	0.04	0.25
		-55.00	0.51	0.70	0.01	
		-82.50	0.82	N/A	0.02	

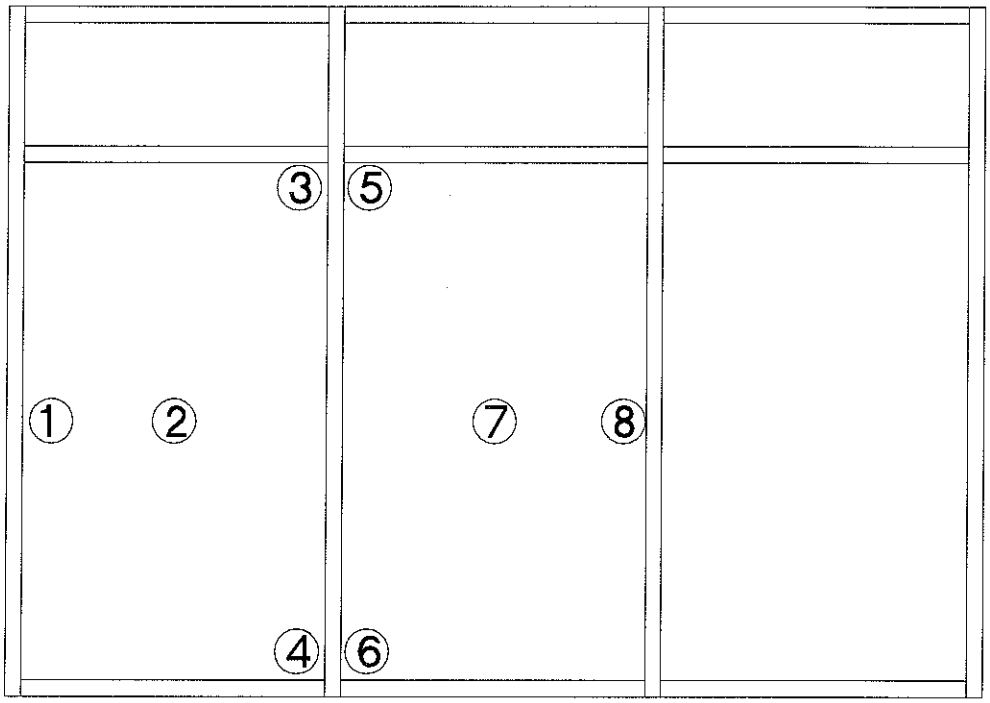
8.3.4 Conclusion – Uniform Static Load Test

HTL observed no signs of failure in any area of these test specimens during the uniform static load test. In addition, each specimen met the deflection and permanent set requirements; as such, these test specimens satisfy the uniform static load test requirements of ASTM E330.

8.4 Small Missile Impact Test

8.4.1 Small Missile Impact Locations

Figures 8.3 and 8.4 show the small missile impact location for the specimens tested.



O-Small Missile Location

Figure 8.3: Small Missile Impact Locations - Specimen 2A

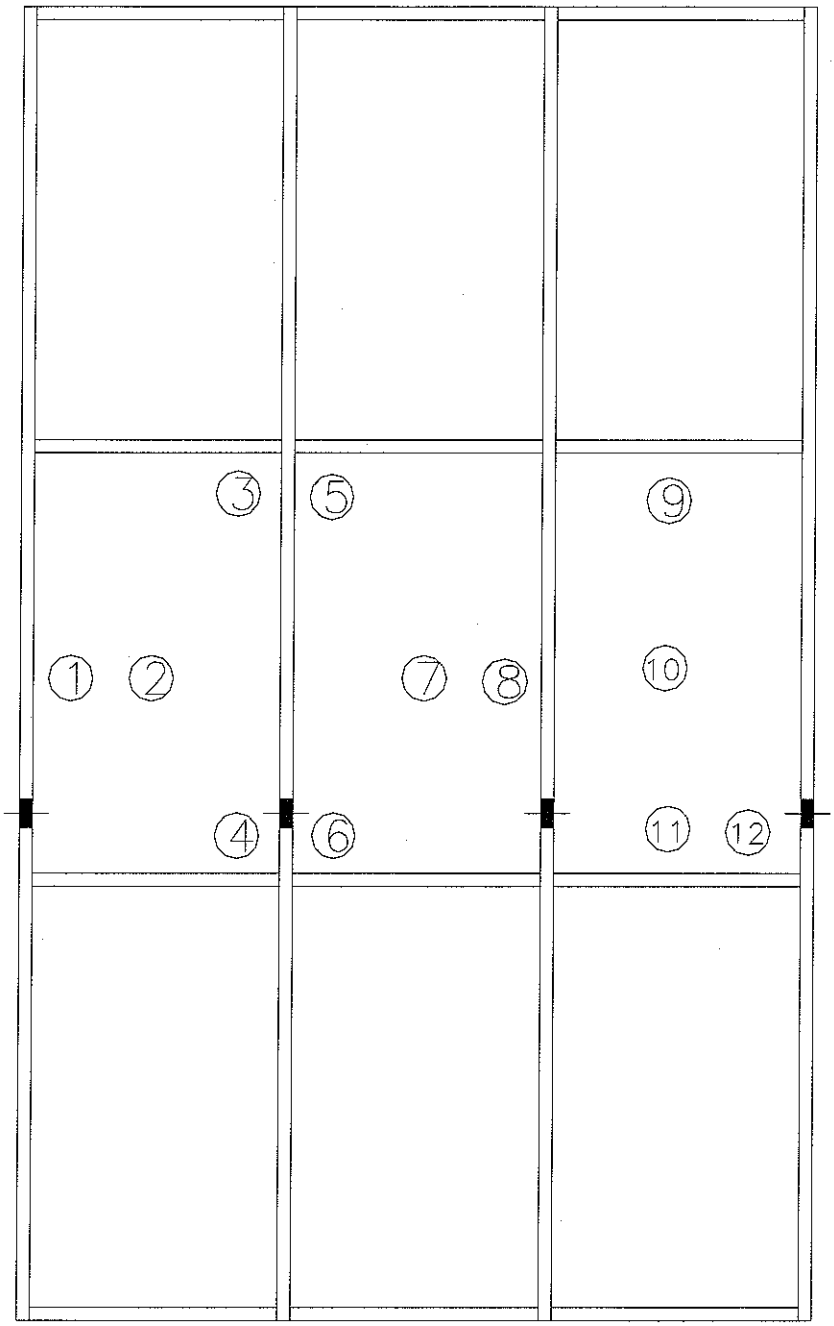


Figure 8.4: Small Missile Impact Locations - Specimen TS1(2)

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8.4.2 Test Results - Small Missile Impact Test

HTL used ten (10) ball bearings with a 5/16" nominal diameter, each weighing between 1.90 and 2.10 grams. Table 8.5 provides the test results for the small missile impact test.

Table 8.5: Small Missile Impact Test Results

Specimen #	Impact #	Missile Velocity (ft/sec)	Glass Temp. (°F)	X Coord.[1] (in.)	Y Coord.[2] (in.)
TS1(2)	1	131.55	75	9.00	148.00
	2	131.25		31.50	148.00
	3	130.89		54.00	189.00
	4	131.74		54.00	106.00
	5	131.43		69.00	189.00
	6	131.86		69.00	106.00
	7	130.28		91.50	148.00
	8	130.04		114.00	148.00
	9	131.07		152.50	189.00
	10	129.68		152.50	148.00
	11	129.92		152.50	106.00
	12	130.70		175.50	106.00
2A	1	129.42	72	9.50	51.00
	2	130.21		32.00	49.00
	3	130.55		54.00	92.00
	4	129.53		54.00	9.00
	5	129.88		69.00	92.00
	6	130.74		69.00	9.00
	7	130.03		90.00	50.00
	8	130.66		115.00	50.00

[1]Measured from the left side of test specimen.
[2]Measured from the bottom of test specimen.

8.4.3 Conclusion - Small Missile Impact Test

The small missiles impacted the intended targets and HTL carefully inspected each impact location. HTL observed no signs of penetration, rupture, or opening after the small missile impact test; as such, these test specimens satisfy the small missile requirements of ASTM E1886/1996.

8.5 Large Missile Impact Test - Level C

8.5.1 Large Missile Impact – Level C Locations

Figures 8.5 and 8.6 show the large missile impact – Level C locations for the specimen tested.

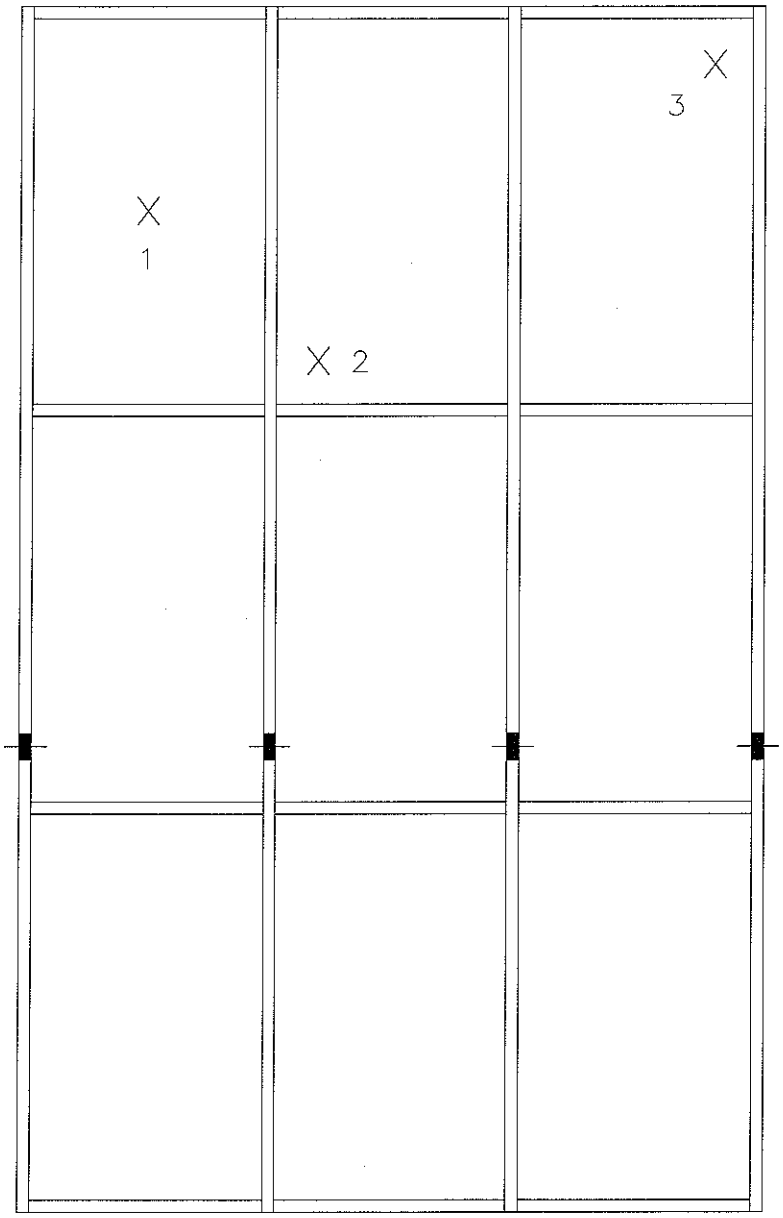

Figure 8.5: Large Missile Impact - Level C Locations - Specimen TS1(2)

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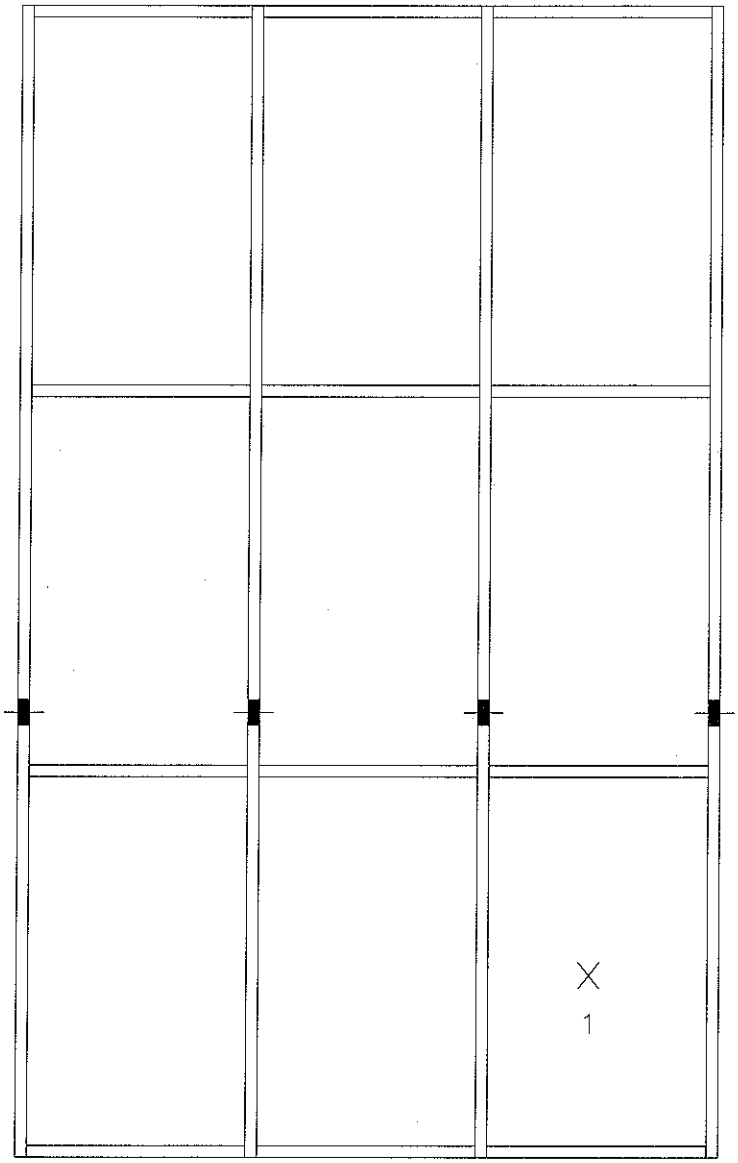

Figure 8.6: Large Missile Impact - Level C Locations - Specimen TS1(2) Retest

8.5.2 Test Results - Large Missile Impact Test

Table 8.6 provides the large missile impact test results.

Table 8.6: Large Missile Impact Test Results

Specimen #	Impact #	Missile Weight (lbs.)	Missile Length (in.)	Missile Velocity (ft/sec)	Glass Temp. (°F)	X Coord.[1] (in.)	Y Coord.[2] (in.)
TS1(2)	1*	4 lbs 5 oz	48"	39.99	73.7	31.50	246.50
	2			39.88	73.7	70.50	206.00
	3			40.11	73.7	169.00	234.63
TS1(2) Retest	1	4 lbs 5 oz	48"	39.38	75.6	150.00	48.00

[1]Measured from the left side of test specimen.
[2]Measured from the bottom of test specimen.

*This impact caused both pieces of laminated glass to crack, since this was not a failure it continued to the cyclic load test and passed. The client requested that the specimen be re-impacted to verify that the cracking was an anomaly. The bottom right lite was re-glazed and impacted and passed without cracking therefore verifying the anomaly.

8.5.3 Conclusion - Large Missile Impact Test

The large missile impacted the intended targets and HTL carefully inspected each impact location. HTL observed no signs of penetration, rupture, or opening after the large missile impact test; as such, this test specimen satisfies the large missile requirements of the ASTM E1886/1996 Level C.

8.6 Large Missile Impact Test

8.6.1 Large Missile Impact Locations

Figures 8.7 and 8.8 show the large missile impact location for the specimens tested.

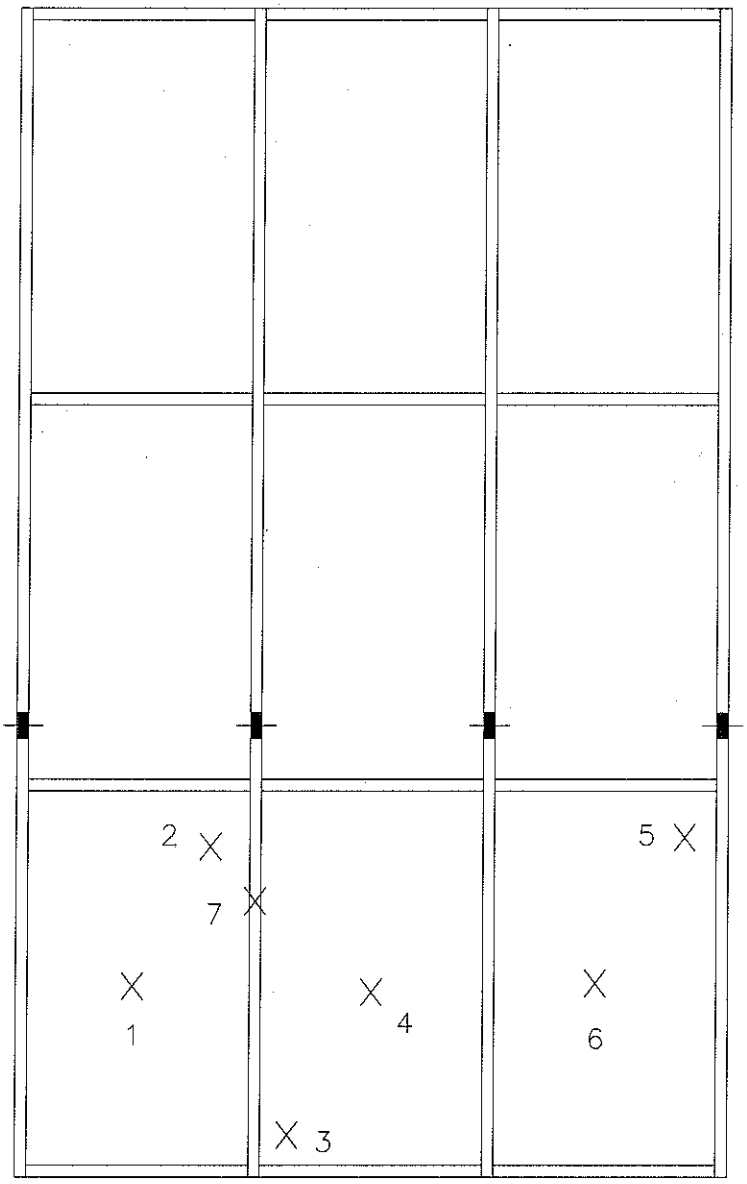

Figure 8.7: Large Missile Impact Locations - Specimen TS1(2)

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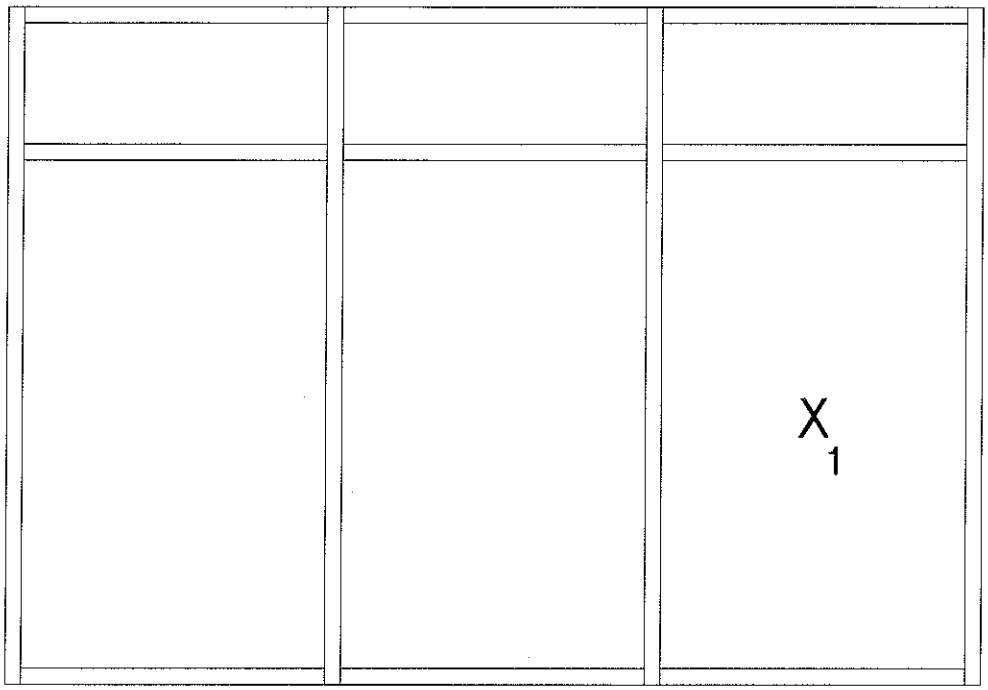

X-Large Missile Location

Figure 8.8: Large Missile Impact Locations - Specimen 2A

8.6.2 Test Results - Large Missile Impact Test

Table 8.7 provides the large missile impact test results.

Table 8.7: Large Missile Impact Test Results

Specimen #	Impact #	Missile Weight (lbs.)	Missile Length (in.)	Missile Velocity (ft/sec)	Glass Temp. (°F)	X Coord.[1] (in.)	Y Coord.[2] (in.)
TS1(2)	1	9 lb 2 oz	92"	50.52	92.0	31.00	50.25
	2			50.53	92.0	52.00	88.25
	3			50.31	92.0	72.50	12.00
	4			49.75	92.0	88.50	48.00
	5			49.41	92.0	169.50	92.25
	6			49.35	92.0	150.00	51.50
	7			50.54	92.0	60.50	76.00
2A	1	9.00	96.00	52.36	72.0	153.00	51.00

[1]Measured from the left side of test specimen.
[2]Measured from the bottom of test specimen.

8.6.3 Conclusion - Large Missile Impact Test

The large missile impacted the intended targets and HTL carefully inspected each impact location. HTL observed no signs of penetration, rupture, or opening after the large missile impact test; as such, these test specimens satisfy the large missile requirements of ASTM E1886/1996 Level D.

8.7 Cyclic Load Test

8.7.1 Deflection Gage Locations - Cyclic Load Test

Figures 8.1 and 8.2 show the deflection gage locations for the cyclic load test. Please refer to Section 8.3.1 for these figures.

8.7.2 Test Spectrum - Cyclic Load Test

Tables 8.8 and 8.9 provide the positive and negative cyclic load test spectrum respectively.

Table 8.8: Positive Load Test Spectrum

Stage	1	2	3	4
Pressure Range (psf)	11.0 – 27.5	0 – 33.0	27.5 – 44.0	16.5 – 55.0
Number of Cycles	3500	300	600	100

Table 8.9: Negative Load Test Spectrum

Stage	5	6	7	8
Pressure Range (psf)	16.5 – 55.0	27.5 – 44.0	0 – 33.0	11.0 – 27.5
Number of Cycles	50	1050	50	3350

8.7.3 Deflection Results - Cyclic Load Test

Table 8.10 shows the cyclic test results for each test specimen.

Table 8.10: Cyclic Load Test Results

Spec. #	Gage Loc.	Inward (Positive Load) Permanent Set		Outward (Negative Load) Permanent Set	
		Measured (in.)	Allowed (in.)	Measured (in.)	Allowed (in.)
TS1(2)	B	0.12	0.12	0.00	0.12
	D	0.06	0.29	0.00	0.29
	G	0.19	0.30	0.00	0.30
	I	0.12	0.12	0.00	0.12
2	B	0.06	0.12	0.08	0.12
	E	0.13	0.25	0.18	0.25

8.7.4 Conclusion - Cyclic Load Test

Upon completion of the cyclic load test, HTL carefully inspected the test specimens for failures. HTL observed no signs of failure; as such, these test specimens satisfy the cyclic load test requirements of ASTM E1886/1996.

9.0 SUMMARY

Table 9.1 provides a summary of the test results for YKK AP America's YHC 300.

Table 9.1: Summary of Test Results

Specimen #	Test Method	Test Conditions	Test Conclusion
TS1(2)	Air Infiltration Test (ASTM E283)	1.57 & 6.24 psf	PASS
TS1(2)	Water Infiltration Test (ASTM E331)	20 psf	PASS
TS1(2) & 2A	Static Load Test (ASTM E330)	+/- 55 psf Design Pressure	PASS
TS1(2) & 2A	Small Missile Impact Test (ASTM E1886/E1996)	--	PASS
TS1(2)	Large Missile Impact Test (ASTM E1886/E1996)	Level C	PASS
TS1(2) & 2A	Large Missile Impact Test (ASTM E1886/E1996)	Level D	PASS
TS1(2) & 2A	Cyclic Load Test (ASTM E1886/E1996)	+/- 55 psf Design Pressure	PASS
TS1(2)	Large Missile Impact Test (ASTM E1886/E1996)	Level C	PASS

10.0 CERTIFICATION AND DISCLAIMER STATEMENT

All tests performed on these test specimens were conducted in accordance with the specifications of the applicable codes, standards and test methods listed below by HTL, LLC. HTL, LLC does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested at HTL. HTL is not owned, operated or controlled by any company manufacturing or distributing products it tests. This report is only intended for the use of the entity named in Section 1.0 of this report. Detailed assembly drawings showing wall thickness of all members, corner construction and hardware applications are on file and have been compared to the test specimens submitted. A copy of this test report along with representative sections of the test specimens will be retained at HTL for a period of three (3) years. All results obtained apply only to the specimens tested and they do indicate compliance with the performance requirements of the test methods and specifications listed in the following section.

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11.0 APPLICABLE CODES, STANDARDS, AND TEST METHODS

ASTM E283-04 – Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330-02 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331-00 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1886-05 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996-09 – Standard Specification for performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

12.0 WITNESSES (ALL OR PARTIAL)

Vinu J. Abraham, P.E.	CEO	HTL, LLC
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ENGINEER OF RECORD
11/3/09

REPORT WRITER
11/3/09

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12/24/2009

Jaime D. Gascon, P.E.
Miami-Dade Building Code Compliance Office
140 West Flagler Street, Suite 1603
Miami, Florida 33130-1563

Re: Application for Product Approval (HTL Test Notifications # HTL09061 & HTLGA0928 for HTL Test Report # 0231-0807-09 & G231-1001-09 #6, Specimen # TS1(2) & 2A)

Dear Mr. Gascon:

This letter is being written as an addendum to the test report previously issued by Hurricane Test Laboratory, LLC (HTL) for the above-mentioned application for product approval. The test report being clarified is labeled HTL Test Report # HTL09061 & HTLGA0928 for HTL Test Report # 0231-0807-09 & G231-1001-09 #6 (Specimen # TS1(2) & 2A) for the YKK AP AMERICA, INC. 300 O.G. Curtainwall System. These clarifications are being made to Sections 5.5.1 and 5.9 of the test report in order to specify the insulated glass edge sealants and spacer used. Please review the following underlined changes:

The following revises section 5.5.1 in the HTL Test Report # 0231-0807-09 & G231-1001-09 #6 (Specimen # TS1(2) & 2A):

5.5.1 Glass Type C consisted of 9/16" thick (nominal) laminated glass consisting of the following components:
- ¼" heat strengthened glass
- 0.060" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

Glass Type G consisted of 9/16" thick (nominal) laminated glass consisting of the following components:
- ¼" heat strengthened glass
- 0.060" DuPont Butacite® PVB Interlayer (Miami-Dade NOA #05-1208.02)
- ¼" heat strengthened glass

Glass Type I consisted of 9/16" thick (nominal) laminated glass consisting of the following components:
- ¼" heat strengthened glass
- 0.035" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

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Glass Type CI consisted of 1-5/16" thick (nominal) insulated laminated glass consisting of the following components:
- ¼" tempered glass
- ½" air space with a spacer assembly with dimensions of 1/2" (w) x 5/8" (h) consisting of an aluminum box spacer around the perimeter of the glass, dual sealed with a primary seal to the glass with polybutylene sealant, and a secondary seal around the perimeter edge with silicone insulating glass sealant
- ¼" heat strengthened glass
- 0.060" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

Glass Type GI consisted of 1-5/16" thick (nominal) insulated laminated glass consisting of the following components:
- ¼" tempered glass
- ½" air space with a spacer assembly with dimensions of 1/2" (w) x 5/8" (h) consisting of an aluminum box spacer around the perimeter of the glass, dual sealed with a primary seal to the glass with polybutylene sealant, and a secondary seal around the perimeter edge with silicone insulating glass sealant
- ¼" heat strengthened glass
- 0.060" DuPont Butacite® PVB Interlayer (Miami-Dade NOA #05-1208.02)
- ¼" heat strengthened glass

Glass Type II consisted of 1-5/16" thick (nominal) insulated laminated glass consisting of the following components:
- ¼" tempered glass
- ½" air space with a spacer assembly with dimensions of 1/2" (w) x 5/8" (h) consisting of an aluminum box spacer around the perimeter of the glass, dual sealed with a primary seal to the glass with polybutylene sealant, and a secondary seal around the perimeter edge with silicone insulating glass sealant
- ¼" heat strengthened glass
- 0.035" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

The following revises section 5.9 in the HTL Test Report # 0231-0807-09 & G231-1001-09 #6 (Specimen # TS1(2) & 2A):

5.9 Sealants Used

Table 5.6 provides a summary of the sealants used in each test specimen.

Table 5.6: Sealant Details

Elevation #	Location	Sealant Description
TS1 (2) – head & sill	Perimeter Sealant	Tremco® Spectrem 2® silicone sealant
TS1 (2) – jambs	Perimeter Sealant	Silicone sheet
2A	Perimeter Sealant	Tremco® Spectrem 2® silicone sealant
TS1 (2) & 2A	Frame Joint Sealant	Tremco® Spectrem 2® silicone sealant
N/A	Glazing Sealant	None used
2A	Insulated Glass Primary Sealant	polybutylene sealant
2A	Insulated Glass Secondary Sealant	silicone insulating glass sealant

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We have enclosed updated, stamped elevation drawings (YKK AP AMERICA, INC. drawings # ELEV-2A, sheet 2A and # ELEV-2A-2, sheet 2A-2) that reflect these revisions.

This letter should provide you with the additional information required for you to continue the fair evaluation of this product/system.

Sincerely,

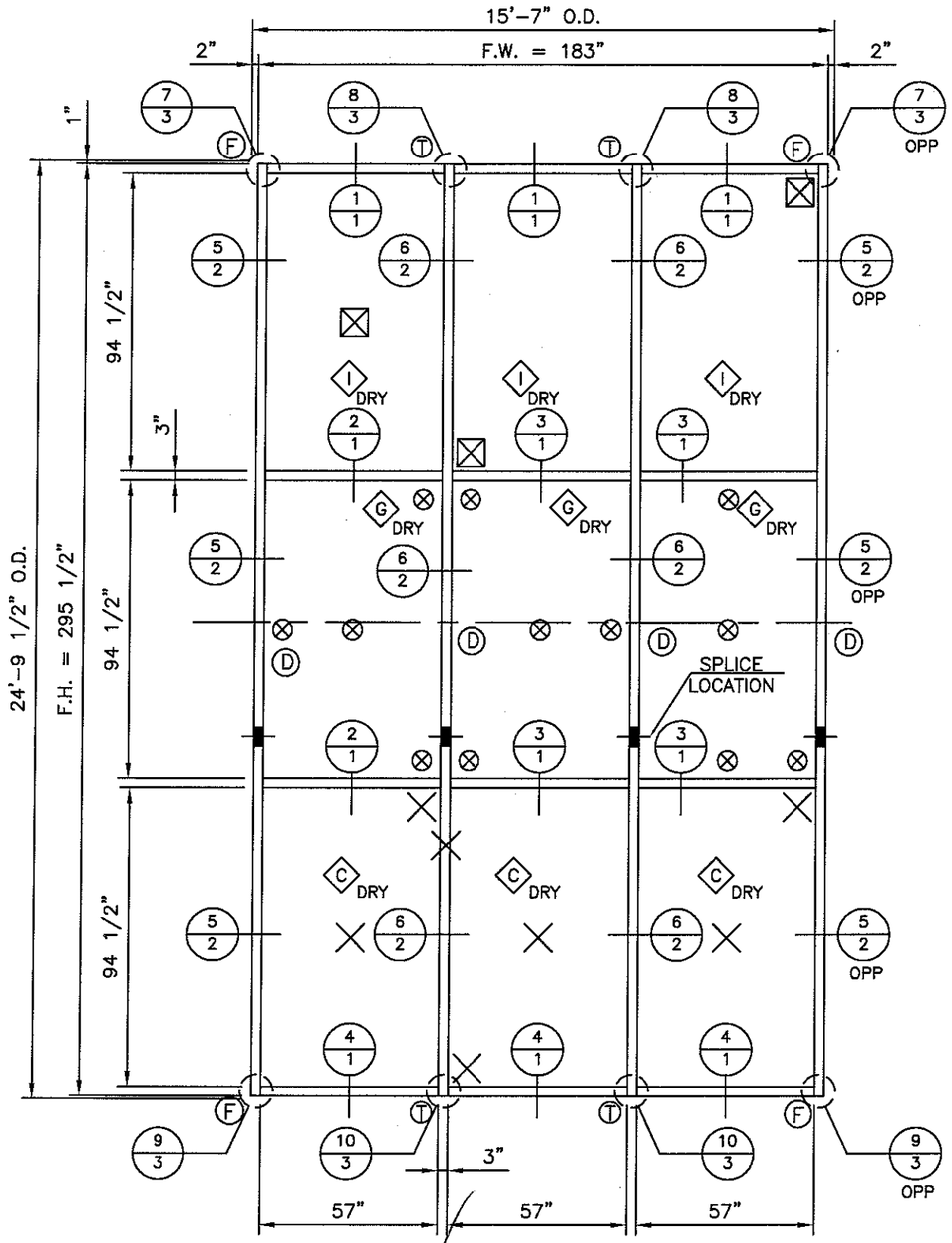
HURRICANE TEST LABORATORY, LLC

Vinu J. Abraham, P.E.
ENGINEER OF RECORD
FL Reg. # 53820

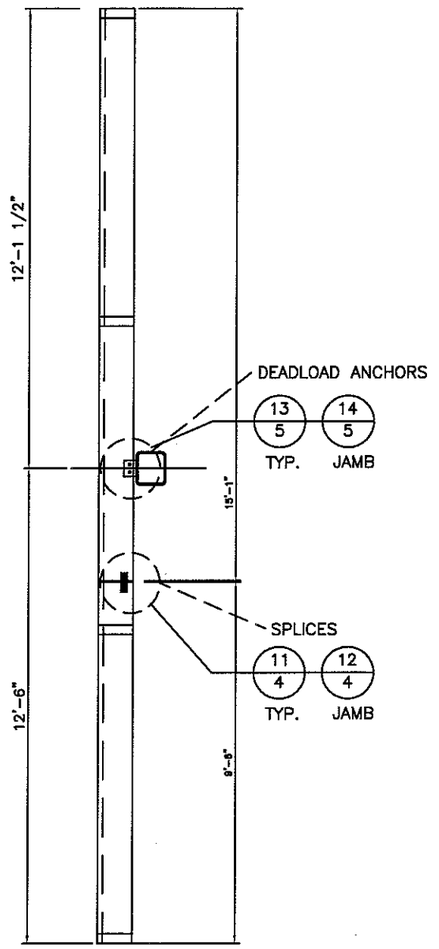
Enclosure

Cc: YKK AP AMERICA, INC.

REV.	DESCRIPTION	BY	DATE



ELEVATION TWIN SPAN 1
(1) req'd
SCALE 1/4" = 1'-0"



HTL

AS TESTED UNLESS OTHERWISE NOTED
DATE 11-2-2009
JOB# 0231-0807-09

GLASS TYPE

C — 9/16" SENTRYGLASS: (LARGE MISSILE) (DRY GLAZED)
1/4" HEAT STRENGTHENED GLASS + 0.060" SENTRYGLASS + 1/4" HEAT STRENGTHENED GLASS

G — 9/16" 0.060 BUTACITE: (SMALL MISSILE) (DRY GLAZED)
1/4" HEAT STRENGTHENED GLASS + 0.060" BUTACITE (PVB) + 1/4" HEAT STRENGTHENED GLASS

I — 9/16" 0.035 SENTRYGLASS: (SMALL MISSILE) (DRY GLAZED)
1/4" HEAT STRENGTHENED GLASS + 0.035" SENTRYGLASS + 1/4" HEAT STRENGTHENED GLASS

NOTES:
1. INSTALLED INTO STEEL STRUCTURE
2. DESIGN PRESSURE LOAD = 55psf
3. TEST TO PERFORM = TAS-202-94
   TAS-201-94
   TAS-203-94

IMPACT LOCATION LEGEND

X LARGE MISSILE IMPACT LOCATION
⊗ SMALL MISSILE IMPACT LOCATION
☒ LEVEL C LARGE MISSILE IMPACT LOCATION

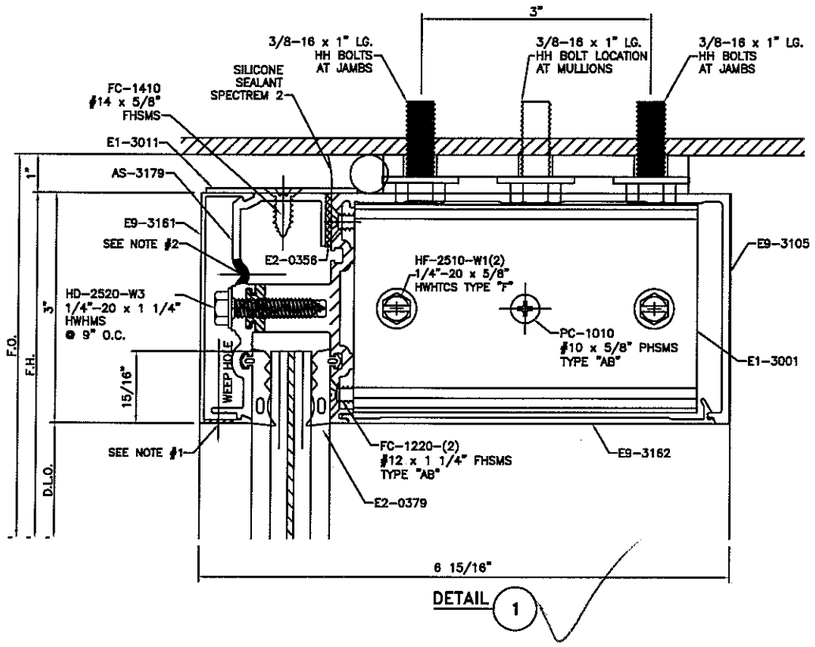
ANCHOR TYPE

Ⓓ: D/L ANCHOR
Ⓕ: 'F' ANCHOR
Ⓣ: 'T' ANCHOR

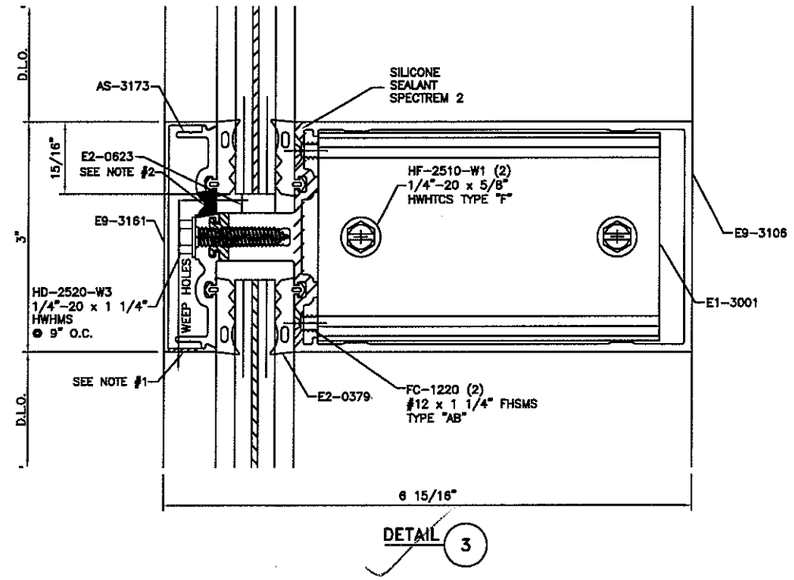
YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: AS NOTED
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: ELEV-TS1	
APPROVED BY: RB / DRAWN BY: DO / DATE: 06/17/09	SHEET NO.: TS1

REV.	DESCRIPTION	BY	DATE



DETAIL 1



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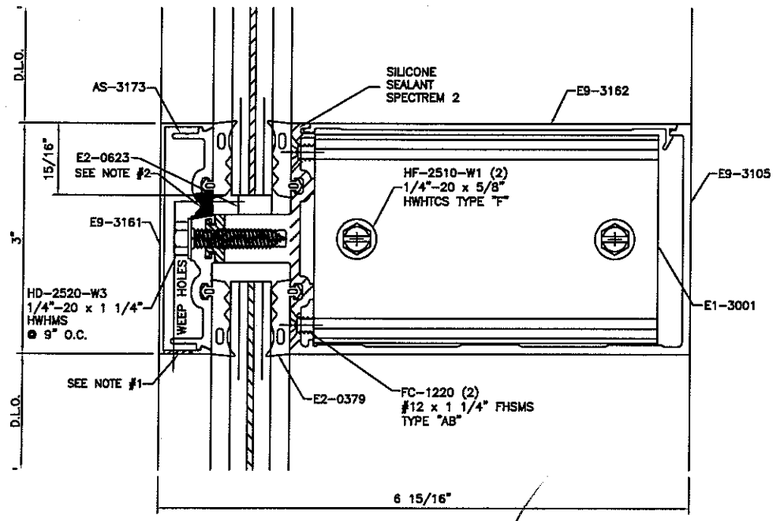
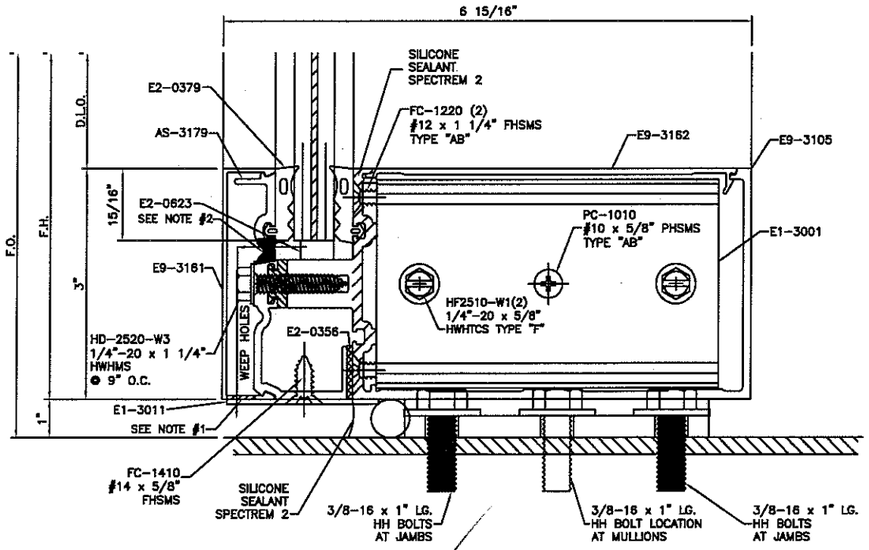


DETAIL 2



DETAIL 4

NOTES:

1. 5/16" DIA. WEEP HOLE (2) PER HORIZONTAL COVER LOCATED @ 1/3 POINTS
2. 5/16" DIA. WEEP HOLE (3) PER HORIZONTAL, 3" FROM EACH END, & ONE IN THE CENTER.

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 11-2-2009

JOB# 0231-0807-09

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-TS1	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/22/09	1

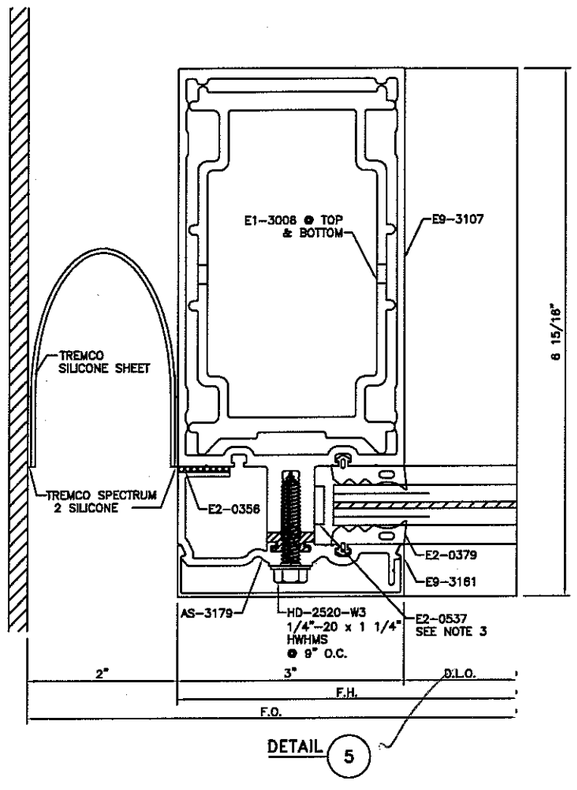
REV.	DESCRIPTION	BY	DATE

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# 0231-0807-09



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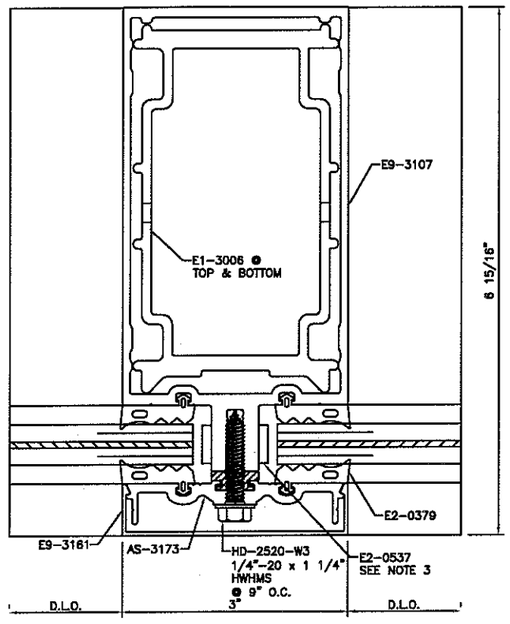


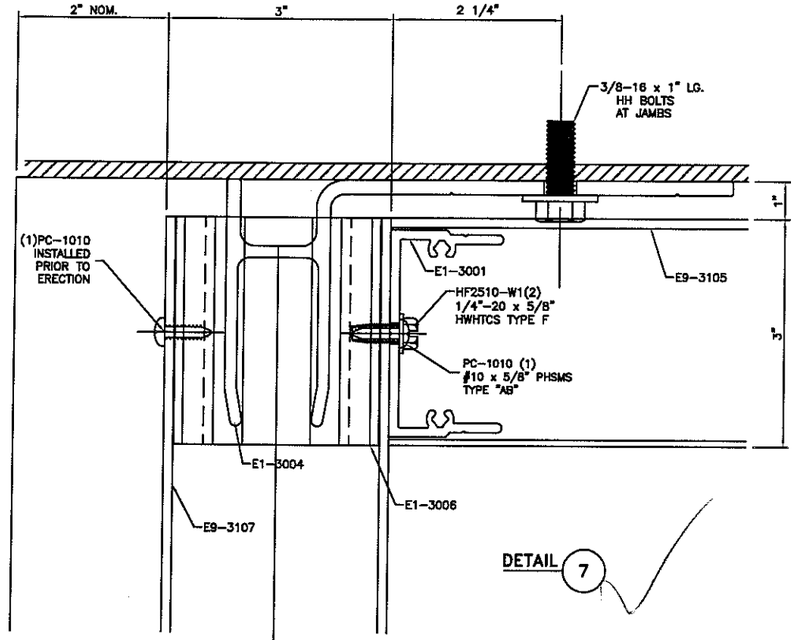
DETAIL 6

NOTE 3: SIDE BLOCK E2-0537 @ QUARTER POINTS

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT			SCALE: HALF
			GLAZING
DESCRIPTION: FORMAL MOCK-UP TEST			
FINISH: PAINTED			
DRAWING NUMBER: DET-TS1			
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/22/09	SHEET NO: 2

REV.	DESCRIPTION	BY	DATE



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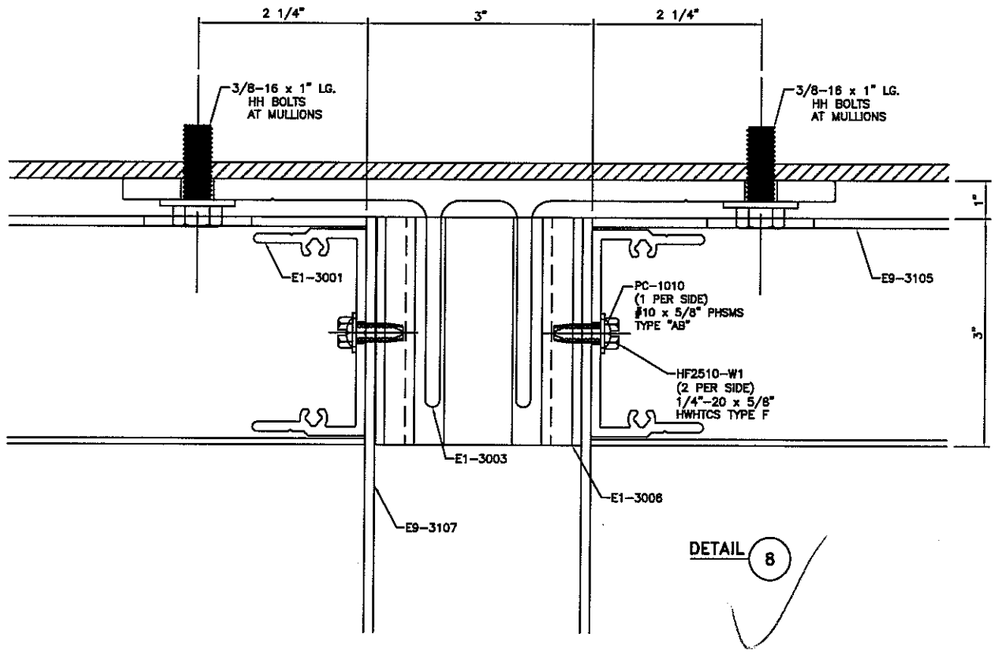
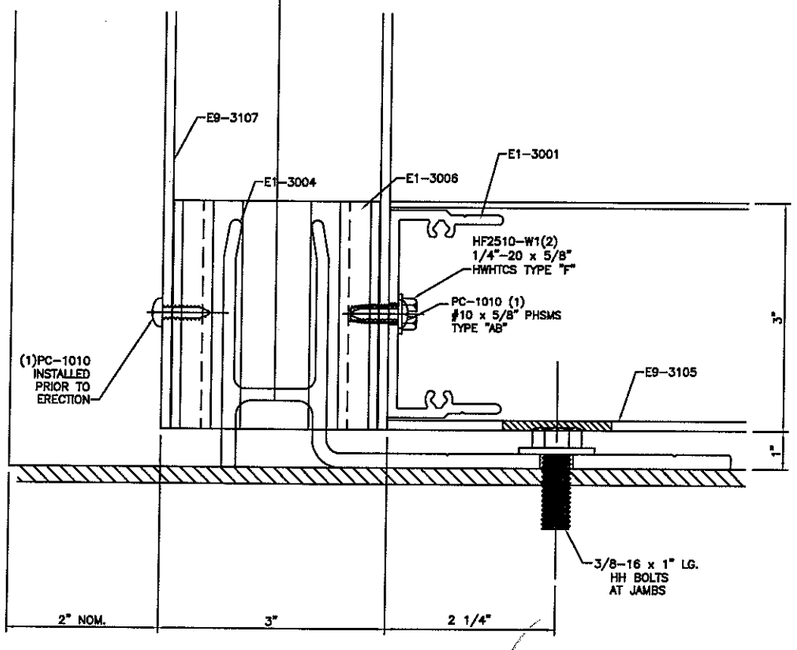
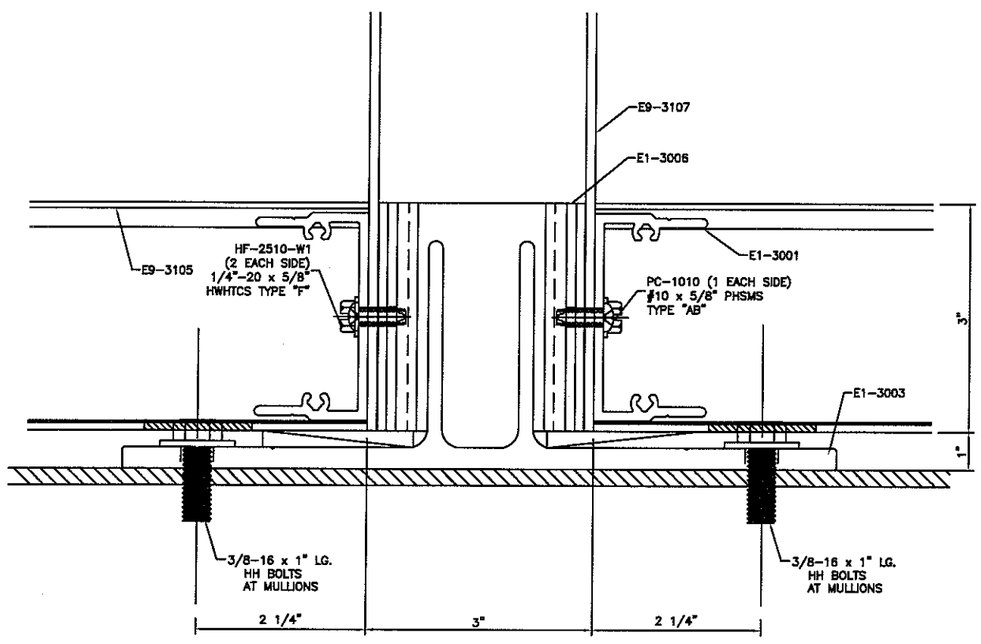


DETAIL 8



DETAIL 9



DETAIL 10

HTL

AS TESTED UNLESS OTHERWISE NOTED

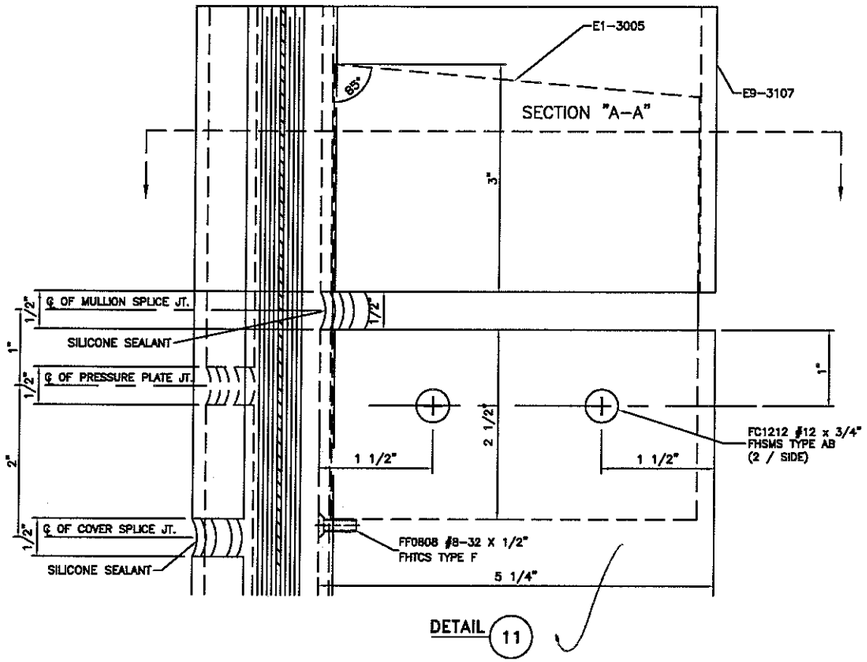
DATE 11-2-2009

JOB# 0231-0807-09

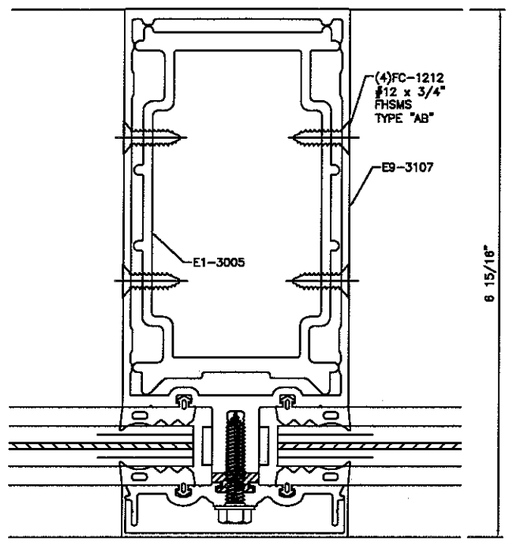
YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT		SCALE: HALF
		GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST		
FINISH: PAINTED		
DRAWING NUMBER: DET-TS1		
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/22/09
		SHEET NO. 3

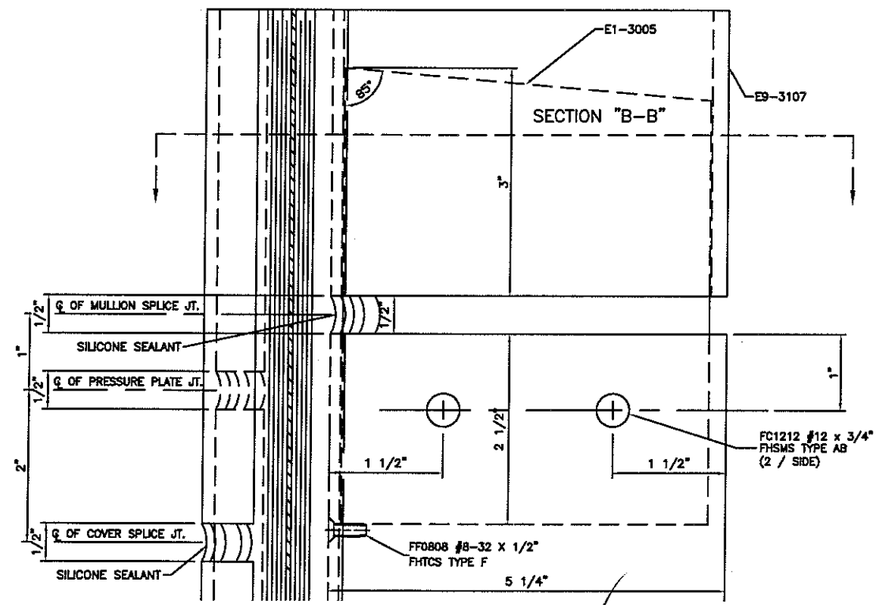
REV.	DESCRIPTION	BY	DATE



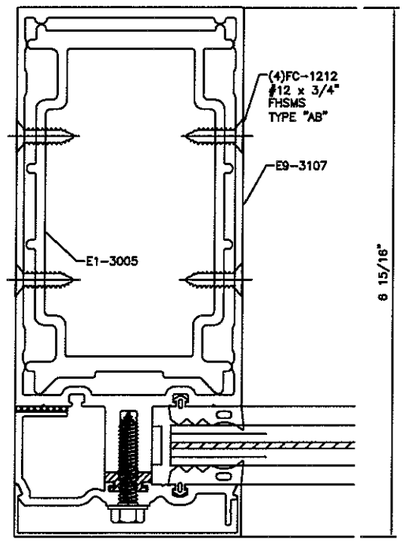
DETAIL 11



SECTION "A-A"



DETAIL 12



SECTION "B-B"

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# 0231-0807-09

YKK AP

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-TS1	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/22/09	4

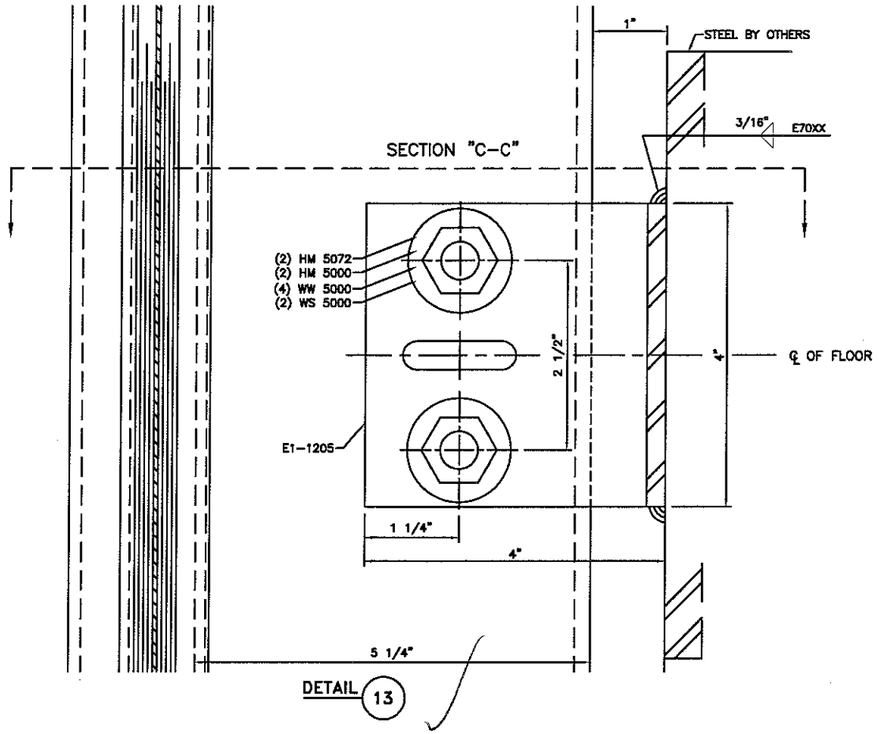
REV.	DESCRIPTION	BY	DATE

HTL

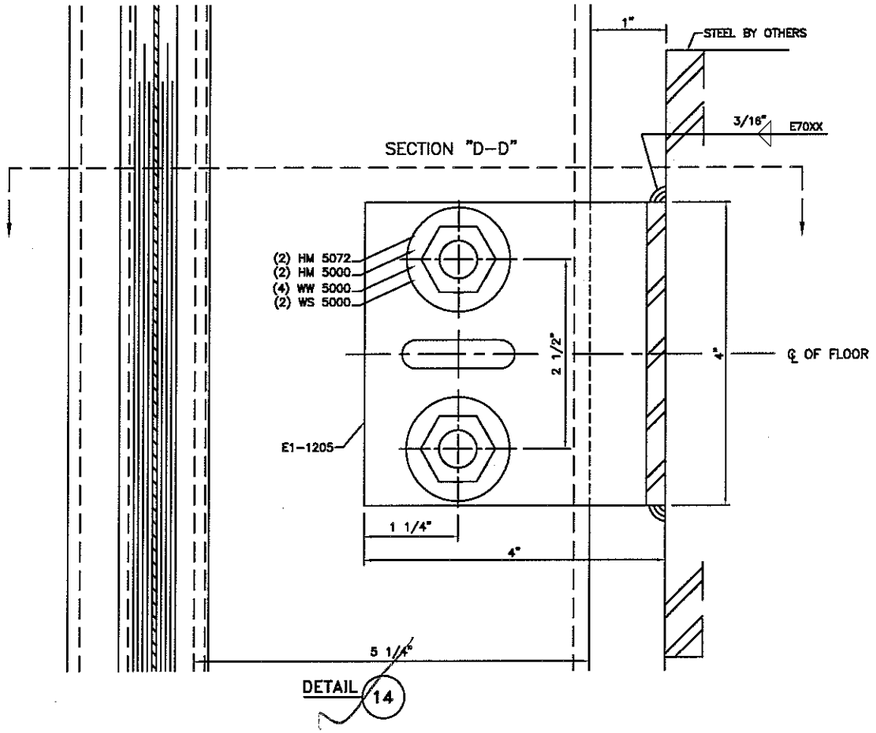
AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

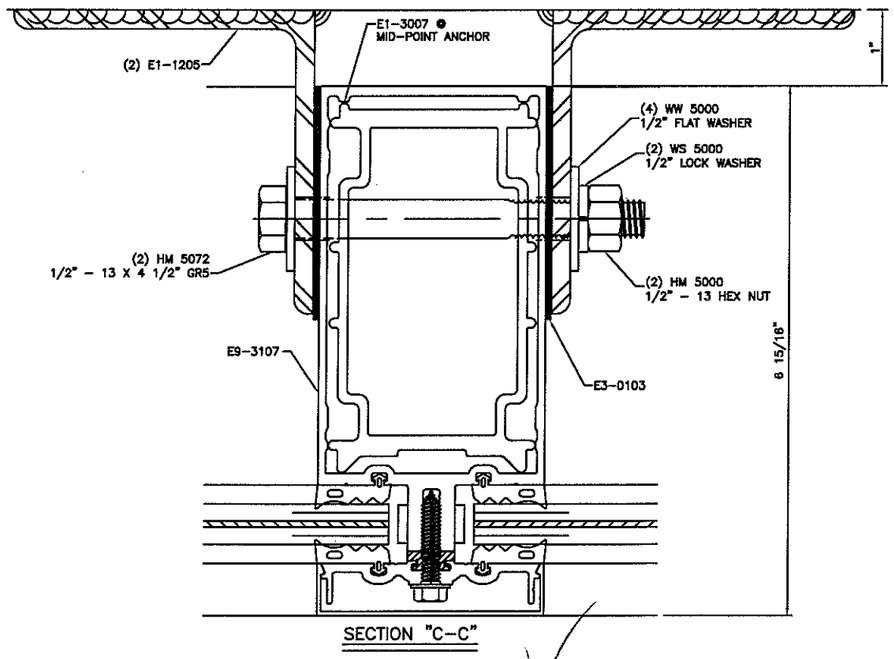
JOB# 0231-0807-09



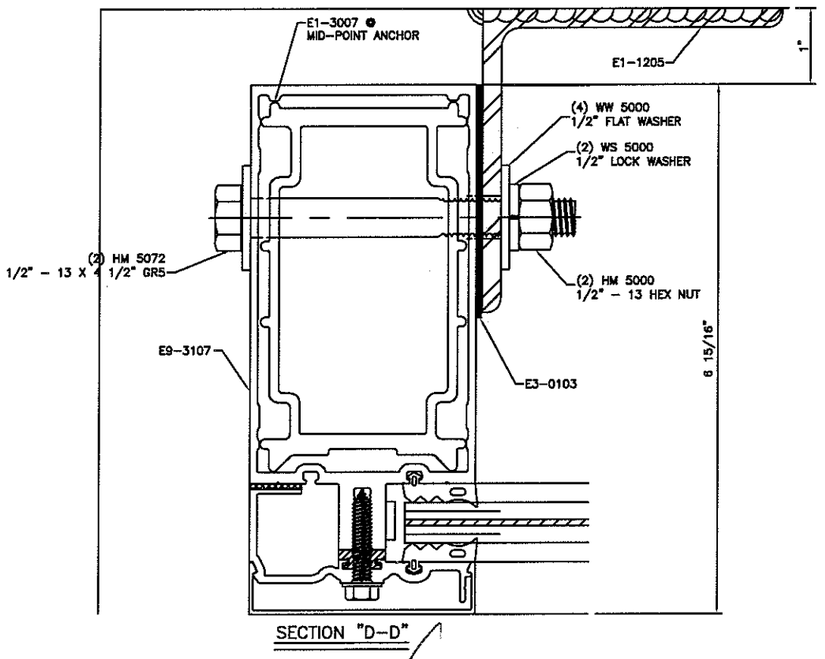
DETAIL 13



DETAIL 14



SECTION "C-C"

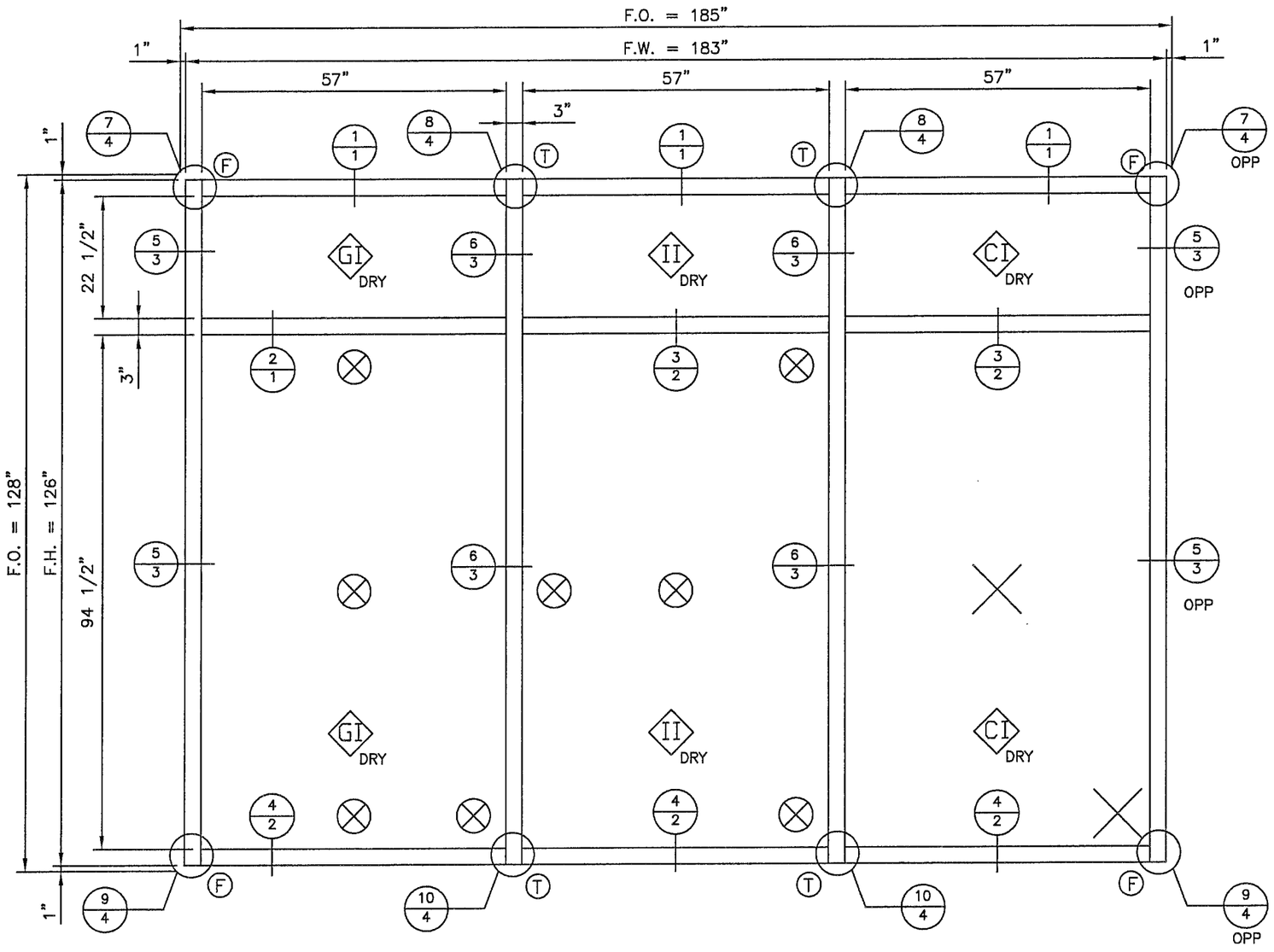


SECTION "D-D"

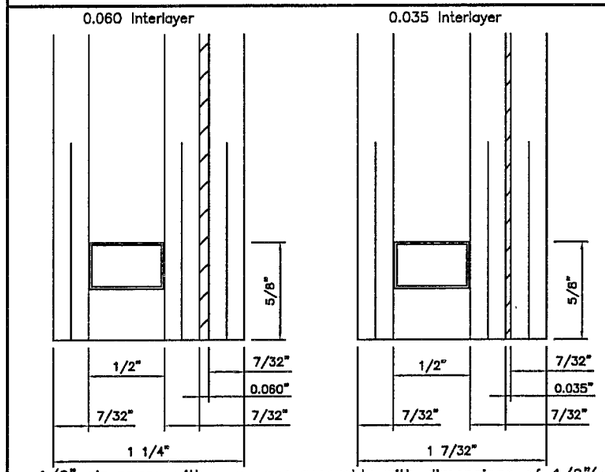
YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT			SCALE: HALF
			GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST			
FINISH: PAINTED			
DRAWING NUMBER: DET-TS1			
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/22/09	SHEET NO: 5

REV.	DESCRIPTION	BY	DATE



IG DRY GLAZED SPACER DATA



1/2" air space with a spacer assembly with dimensions of 1/2"(w) x 5/8"(h) consisting of an aluminum box spacer around the perimeter of the glass, dual sealed with a primary seal to the glass with polyibutylene and a secondary seal around the perimeter edge with silicone insulating glass sealant

GLASS TYPE

CI — 1 5/16" SENTRYGLASS: (LARGE MISSILE)
1/4" TEMPERED GLASS + 1/2" AIR SPACE +
1/4" HEAT STRENGTHENED GLASS + 0.060" SENTRYGLASS +
1/4" HEAT STRENGTHENED GLASS

GI — 1 5/16" 0.060 BUTACITE (SMALL MISSILE):
1/4" TEMPERED GLASS + 1/2" AIR SPACE +
1/4" HEAT STRENGTHENED GLASS + 0.060" BUTACITE (PVB) +
1/4" HEAT STRENGTHENED GLASS

II — 1 5/16" 0.035 SENTRYGLASS: (SMALL MISSILE) (DRY GLAZED)
1/4" TEMPERED GLASS + 1/2" AIR SPACE +
1/4" HEAT STRENGTHENED GLASS + 0.035" SENTRYGLASS +
1/4" HEAT STRENGTHENED GLASS

NOTE:
1. DESIGN PRESSURE LOAD = 55psf.
2. TEST TO PERFORM = E1996 WZ3
= TAS 202-94 (1) only

HTL
AS TESTED UNLESS OTHERWISE NOTED
DATE 12-24-2009
JOB# 0231-0807-09

ELEVATION 2A
(1) req'd
SCALE 1/2" = 1'-0"

IMPACT LOCATION LEGEND
X LARGE MISSILE IMPACT LOCATION
⊗ SMALL MISSILE IMPACT LOCATION

ANCHOR TYPE

Ⓕ: 'F' ANCHOR
Ⓣ: 'T' ANCHOR

YKK ap

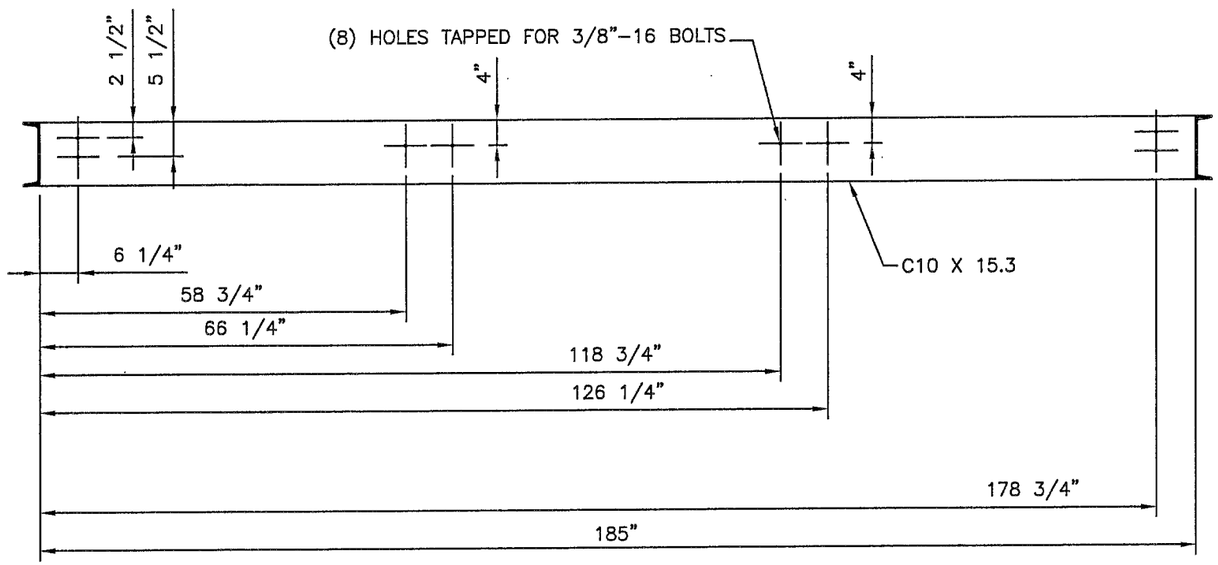
SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT MULLION NO REINFORCEMENT	SCALE: AS NOTED
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: ELEV-2A	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/17/09	2A

M:\Product Teams\Wall Team\Curtain Wall\YHC 300 OG\Test Documents\Takeoff Drawings\Elevations\Elev 2A.dwg

REV.	DESCRIPTION	BY	DATE

ELEVATION 2A:
FRAME OPENING WIDTH = 185"
FRAME OPENING HEIGHT = 128"



SCALE 1/2" = 1'-0"

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 12-24-2009

JOB# 0231-0807-09

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT			SCALE: AS NOTED
			GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST			
FINISH: PAINTED			
DRAWING NUMBER: ELEV-2A-2			
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/17/09	SHEET NO.: 2A-2

M:\Product Teams\Wall Team\Curtain Wall\YHC 300 OG\Test Documents\Takeoff Drawings\Elevations\Elev 2A.dwg

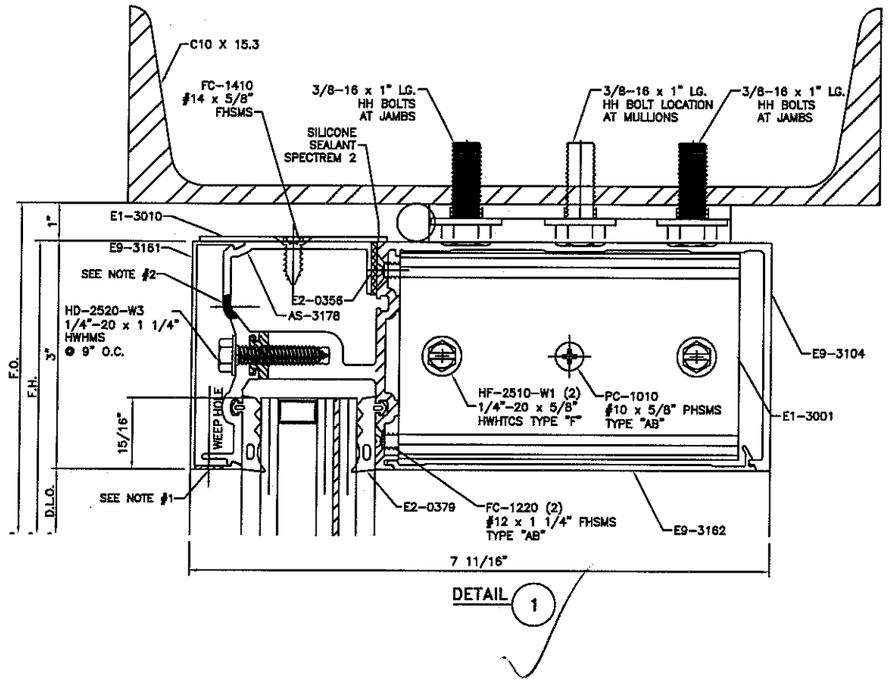
REV.	DESCRIPTION	BY	DATE

HTL

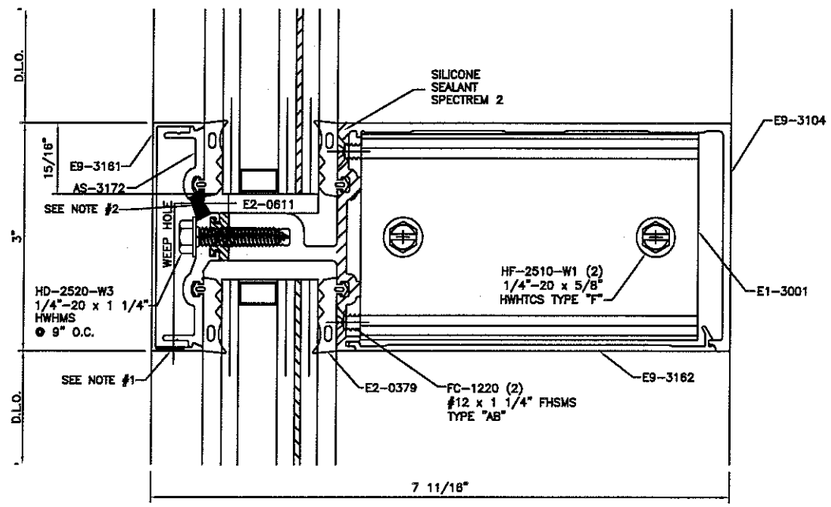
AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09



DETAIL 1



DETAIL 2

NOTES:

1. 5/16" DIA. WEEP HOLE (2) PER HORIZONTAL COVER LOCATED @ 1/3 POINTS
2. 5/16" DIA. WEEP HOLE (3) PER HORIZONTAL, 3" FROM EACH END, & ONE IN THE CENTER.

YKK AP

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT		SCALE: HALF
		GLAZING
DESCRIPTION: FORMAL MOCK-UP TEST		
FINISH: PAINTED		
DRAWING NUMBER: DET-2A		
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/17/09
		SHEET NO: 1

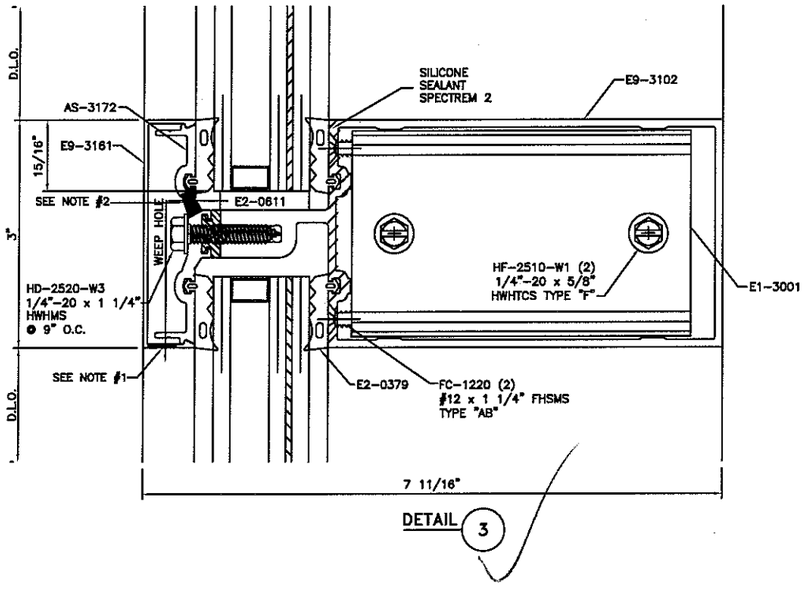
REV.	DESCRIPTION	BY	DATE

HTL

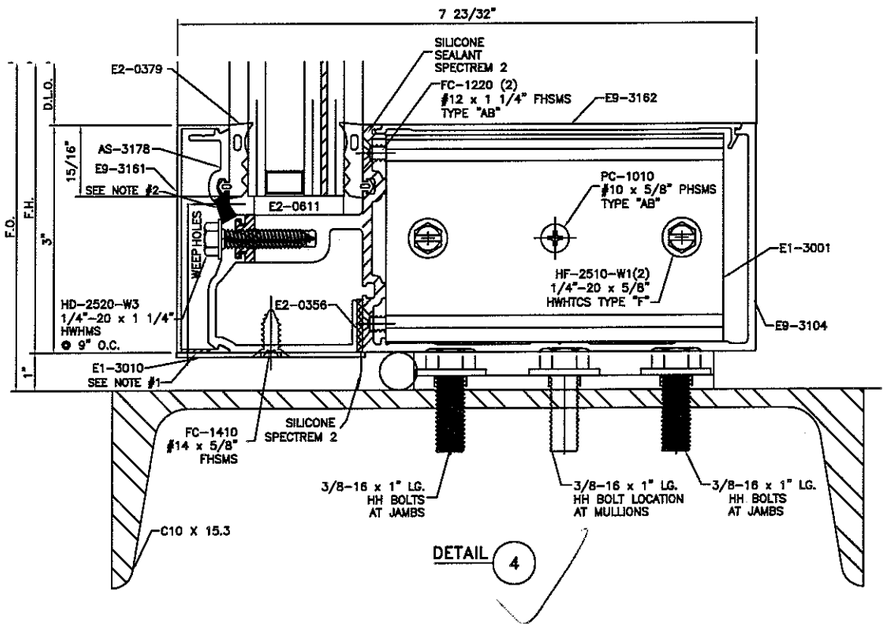
AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09



DETAIL 3



DETAIL 4

NOTES:

1. 5/16" DIA. WEEP HOLE (2) PER HORIZONTAL COVER LOCATED @ 1/3 POINTS
2. 5/16" DIA. WEEP HOLE (3) PER HORIZONTAL, 3" FROM EACH END, & ONE IN THE CENTER.

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-2A	
APPROVED BY: RB / DRAWN BY: DO / DATE: 06/17/09	SHEET NO. 2

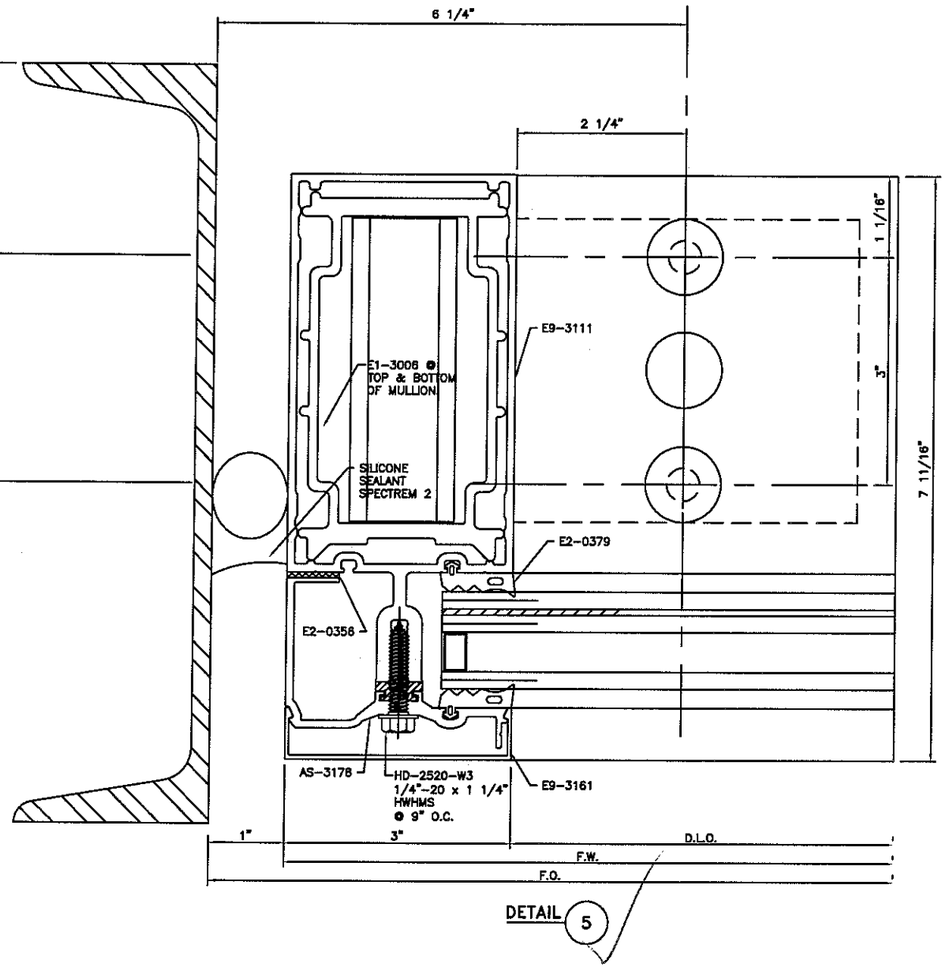
REV.	DESCRIPTION	BY	DATE

HTL

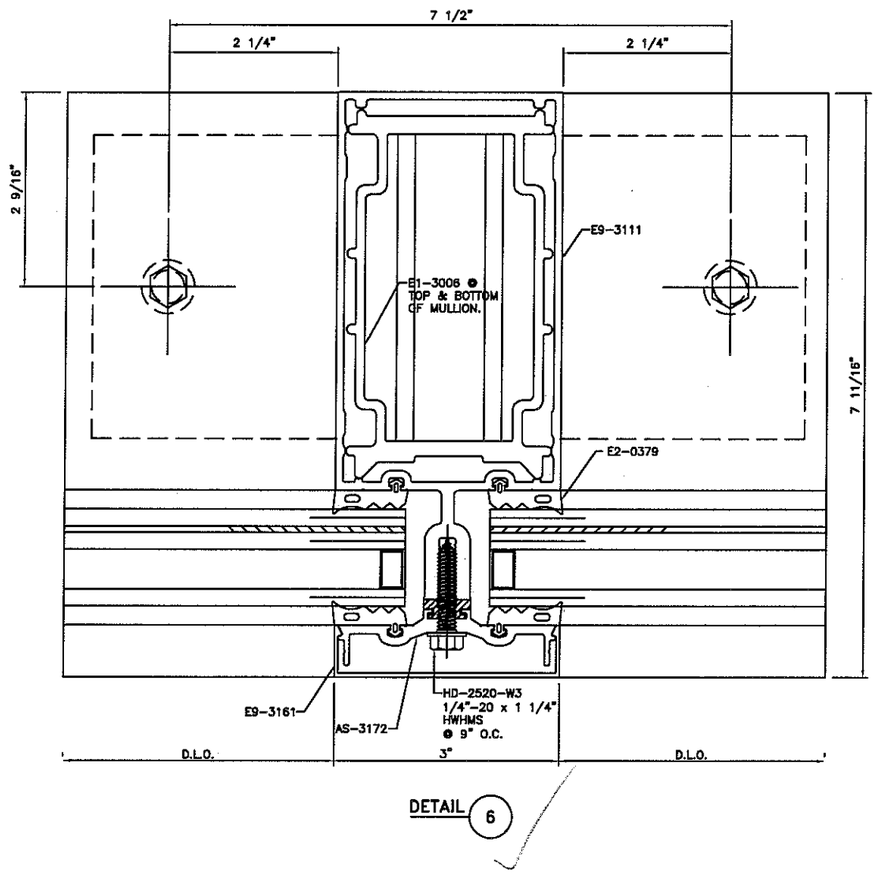
AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09



DETAIL 5

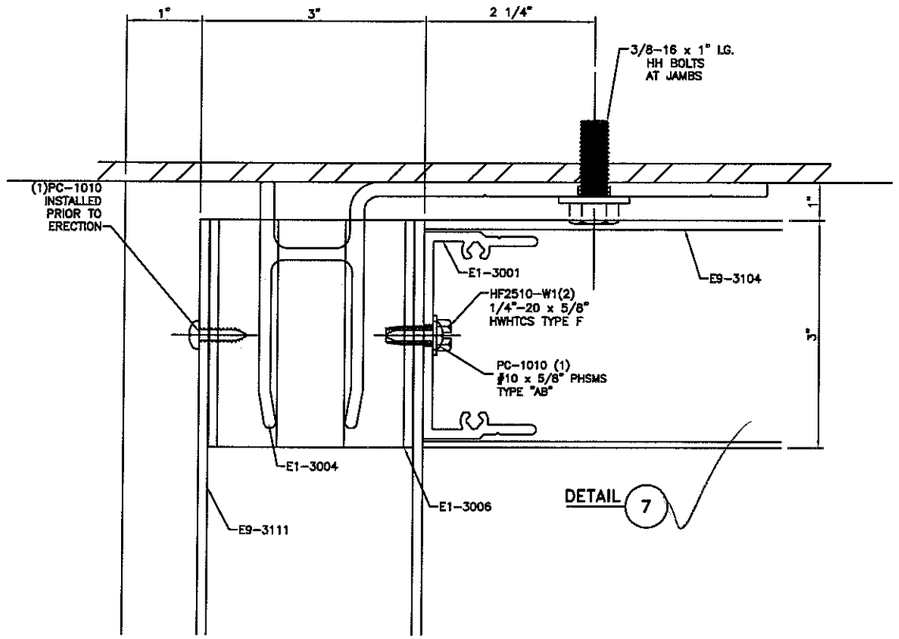


DETAIL 6

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT			SCALE: HALF; GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST			
FINISH: PAINTED			
DRAWING NUMBER: DET-2A			
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/17/09	SHEET NO.: 3

REV.	DESCRIPTION	BY	DATE



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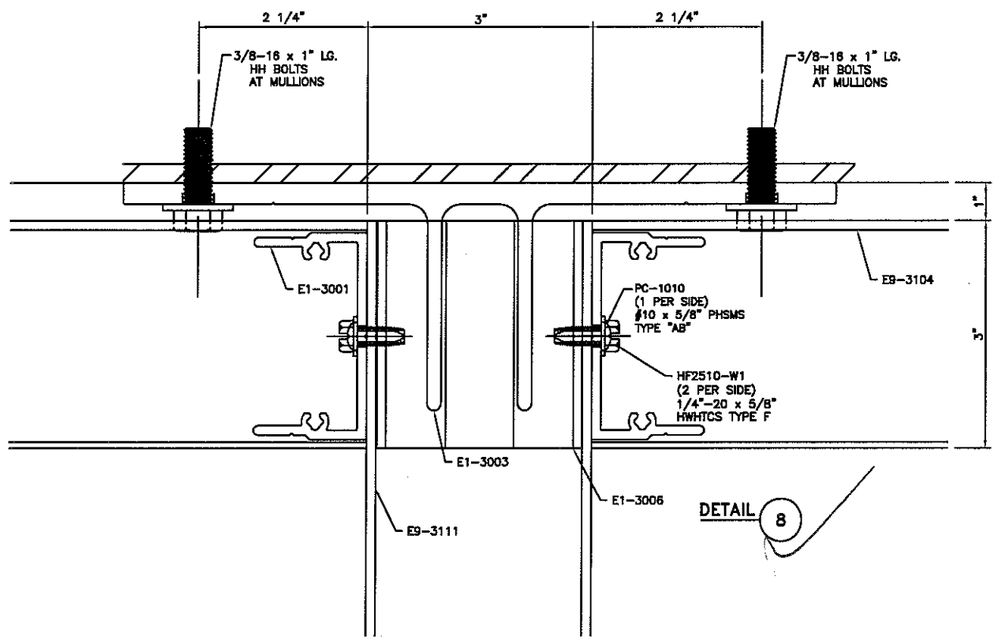

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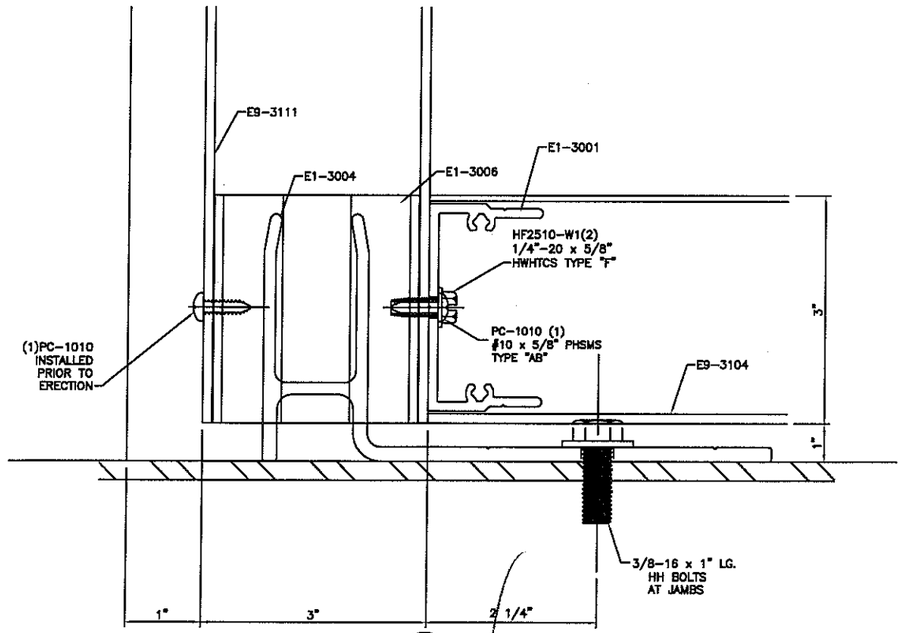
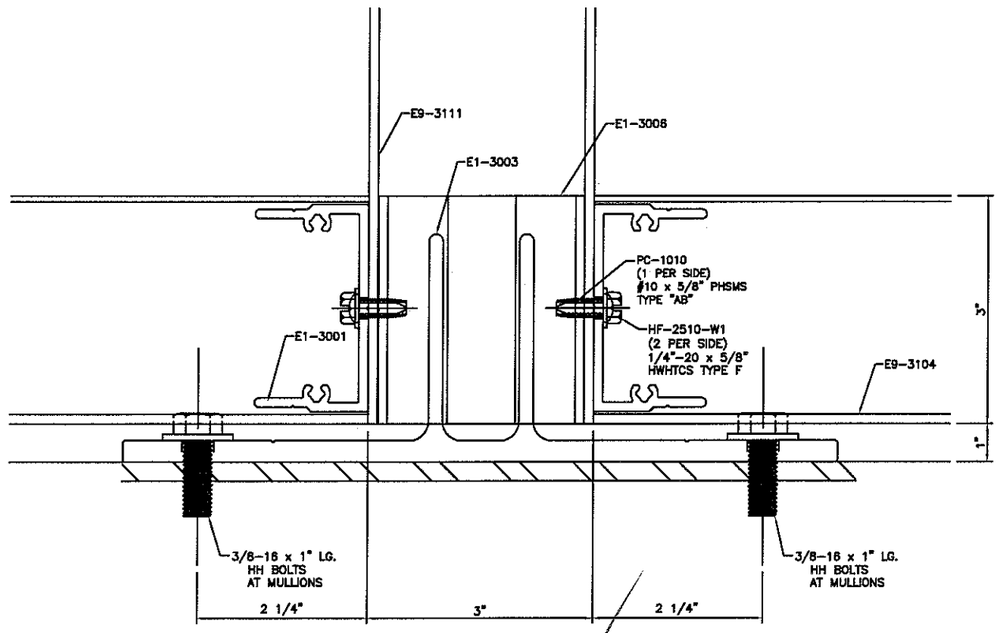


DETAIL 9



DETAIL 10

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) LIGHT NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-2A	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/17/09	4

YKK AP AMERICA, INC.

Curtainwall
Test Report #: G231-1001-09

1.0 MANUFACTURER'S IDENTIFICATION

1.1	Name of Applicant:	YKK AP AMERICA, INC. 7680 The Bluffs, Suite 100 Austell, GA 30168 Voice: (678) 838-6095 Fax: (678) 838-6056
1.2	Contact Person:	Don Pangburn

2.0 LABORATORY IDENTIFICATION

2.1	HTL Test Notification:	HTLGA0928
2.2	HTL Lab Certifications:	Miami-Dade County (05-1014.01); Florida Building Code (TST1527); IAS (TL-244); AAMA; WDMA; Keystone Certificate; Texas Department of Insurance

3.0 SCOPE OF WORK

3.1 Introduction

YKK AP AMERICA, INC. retained HTL, LLC to conduct Florida Building Code standard testing on their YHC 300 O.G. Curtainwall system.

3.2 Report Information

Table 3.1 provides the test dates for each mock-up and specimen number.

Table 3.1: Specimen Test Dates

Mock-Up	Specimen #	Test Date
3	3	10/21-22/09
3A	3A	10/20-21/09

4.0 PRODUCT IDENTIFICATION

4.1	Product Type:	Curtainwall
4.2	Model Designation:	YHC 300 O.G.
4.3	Performance Class:	+/-65 psf Design Pressure

VINU J. ABRAHAM LICENSE NO. 53820 STATE OF FLORIDA PROFESSIONAL ENGINEER

ENGINEER OF RECORD
Vinu J. Abraham, P.E.
FL Reg. #53820
11/2/2009

REPORT WRITER
Angela Abramczyk
11/2/2009

4.4 Overall Size & Configuration: Table 4.1 provides the overall size for each mock-up/specimen number. The table also indicates which YKK AP AMERICA, INC. drawing number and sheet to see for the configuration of each mock-up.

Table 4.1: Specimen Overall Size

Mock-Up	Specimen #	Overall Size	Drawing/Sheet #
Elevation 3	3	243" (w) x 126" (h)	ELEV-3/3
Elevation 3A	3A	243" (w) x 162" (h)	ELEV-3A/3A

4.5 Number of Operable Panels: None

4.6 Drawing: This test report is incomplete if not accompanied by the YKK AP AMERICA, INC. drawing numbers indicated in Table 4.2. bearing the ink stamp of Hurricane Test Laboratory, LLC.

Table 4.2: Drawing Numbers

Elevation #	Drawing #	Sheets
3	ELEV-3	3
3	DET-3	1 - 4
3A	ELEV-3A	3A
3A	DET-3A	1 - 4

4.7 Sample Source: Samples provided by YKK AP AMERICA, INC.

5.0 PRODUCT DESCRIPTION

5.1 Frame Construction

The framing members were fabricated using the aluminum extrusions defined in Table 5.1.

Table 5.1: Aluminum Extrusion Details

Description	Part #	Overall Cross-Section	Alloy/Temper
Elevation 3			
Head & Sill	E9-3105	6.110" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (left bay)	E9-3105	6.110" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (all other areas)	E9-3106	6.110" x 3.000" x 0.100"	6063-T5
Mullion	E9-3103	3.000" x 6.120" x 0.125"	6063-T6
Flush Filler (for E9-3105)	E9-3162	4.890" x 0.331" x 0.079"	6063-T5
Elevation 3A			
Head & Sill	E9-3104	6.678" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (left bay)	E9-3104	6.678" x 3.000" x 0.100"	6063-T5
Intermediate Horizontal (all other areas)	E9-3102	6.678" x 3.000" x 0.100"	6063-T5
Mullion	E9-3101	3.000" x 6.688" x 0.125"	6063-T6
Flush Filler (for E9-3104)	E9-3162	4.890" x 0.331" x 0.079"	6063-T5

5.1.1 Typical Frame Corner Construction

At each frame corner, the vertical frame member ran through while the horizontal frame member end was square cut, butted and mechanically fastened to the vertical frame member via a 4-1/2" (long) aluminum shear block (Part #E1-3001). At each frame corner, the shear block was attached to the vertical frame member using two (2), ¼"-20 x 5/8" HWH TCS (Type F). Each horizontal frame member end was attached to the adjacent shear block using two (2), #12 x 1-1/4" FH SMS (Type AB).

5.1.2 Frame Joint Sealant

At each frame joint, the exterior leg of each horizontal frame member was sealed with a bead of Tremco® Spectrem 2® silicone sealant prior to its attachment to the shear block.

5.1.3 End Cap & Anchor Sleeve Construction

There was a mullion end cap (Part # E1-3011 for Elevation 3 & E1-3010 for Elevation 3A) attached to the top and bottom end of each mullion and jamb using one (1), #14 x 5/8" FH SMS. NOTE: One (1), 3" long anchor sleeve (Part #E1-3006) was inserted into the top and bottom of each mullion end and secured in place using two (2), #10 x 5/8" PH SMS (Type AB).

5.1.4 Miscellaneous Construction

There was a continuous filler (Part # E9-3162) used at the interior frame head, sill and some intermediate horizontal (see above Table 5.1 "Aluminum Extrusion Details" for where the intermediate horizontals would apply) locations between each mullion.

5.2 Pressure Plate and Snap Cover Assembly

Table 5.2 provides the extrusions used in the pressure plate and snap cover assemblies.

Table 5.2: Pressure Plate and Snap Cover Details

Description	Part #	Overall Cross-Section	Alloy/Temper
Elevation 3			
Perimeter Pressure Plate	E9-3179	2.955" x 1.489" x 0.100"	6063-T5
Intermediate Horizontal/Vertical Pressure Plate	E9-3173	2.910" x 0.566" x 0.115"	6063-T5
Snap Cover	E9-3161	3.000" x 0.687" x 0.056"	6063-T5
Elevation 3A			
Perimeter Pressure Plate	E9-3178	2.955" x 1.976" x 0.100"	6063-T5
Intermediate Horizontal/Vertical Pressure Plate	E9-3172	2.910" x 0.743" x 0.115"	6063-T5
Snap Cover	E9-3161	3.000" x 0.687" x 0.056"	6063-T5

5.2.1 Pressure Plates

Each continuous pressure plate (Part # E9-3178, E9-3179, E9-3172 or E9-3173) was square cut at each end and secured to the adjacent frame member using a single row of ¼"-20 x 1-1/4" HWH MS spaced 1-1/2" from each end and at 9" on center thereafter. NOTE: A continuous EPDM thermal isolator (Part # E2-0103) was applied to the centerline of each pressure plate prior to its installation. A continuous strip of 0.125" x 0.688" sponge isolator tape (Part # E2-0356) was applied to the perimeter leg of each perimeter pressure plate prior to its installation. The

"AS" part #s called out in the details are the assembled pressure plates with this EPDM thermal isolator and (if applicable) the sponge isolator tape applied to the perimeter pressure plate. YKK AP AMERICA, INC. does not produce separate drawings for "AS" part numbers.

5.2.2 Snap Covers
At the exterior of all pressure plates, the snap covers (Part # E9-3161) were snap fit to the pressure plate.

5.3 Vertical Reinforcement
None used

5.4 Glazing Details

5.4.1 Glazing Materials
Glass Type A consisted of 9/16" thick (nominal) laminated glass consisting of the following components:
- ¼" heat strengthened glass
- 0.090" DuPont Butacite® PVB Interlayer (Miami-Dade NOA #05-1208.02)
- ¼" heat strengthened glass

Glass Type D consisted of 9/16" thick (nominal) laminated glass consisting of the following components:
- ¼" heat strengthened glass
- 0.090" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

Glass Type AI consisted of 1-5/16" thick (nominal) insulated laminated glass consisting of the following components:
- ¼" tempered glass
- ½" air space
- ¼" heat strengthened glass
- 0.090" DuPont Butacite® PVB Interlayer (Miami-Dade NOA #05-1208.02)
- ¼" heat strengthened glass

Glass Type DI consisted of 1-5/16" thick (nominal) insulated laminated glass consisting of the following components:
- ¼" tempered glass
- ½" air space
- ¼" heat strengthened glass
- 0.090" DuPont SentryGlas® ionoplast interlayer (Miami-Dade NOA #09-0312.03)
- ¼" heat strengthened glass

5.4.2 Glazing Method
The glass lites used in these test specimens were exterior glazed using the following (typical) procedures:
Interior Side: Using strips of EPDM spacer gasket (Part #E2-0353) followed by a 1/4" x 1/2" continuous bead of Dow Corning® 995 Silicone Structural Glazing Sealant
Exterior Side: Using strips of EPDM gasket (Part # E2-0379)

5.4.3 Daylight Opening and Glass Bite
The glass types for each lite were per the YKK AP AMERICA, INC. drawing numbers and sheets indicated in Table 5.3, without modifications.

Table 5.3: Daylight Opening and Glass Bite Details

Elevation #	Qty.	Daylight Opening	Glass Bite	Drawing #	Sheet #
3 & 3A	4	57" (w) x 22-1/2" (h)	15/16"	ELEV-3 & ELEV-3A	3 & 3A
	4	57" (w) x 94-1/2" (h)	15/16"		

5.5 Weather Stripping
None used

5.6 Hardware
None used

5.7 Weep Holes, Water Diverters, and Covers
Table 5.4 provides the weep holes used in these test specimens.

Table 5.4: Weep Hole Details

Qty.	Location	Description
2/snap cover	At the third points of each exterior horizontal snap cover	5/16" diameter weep hole
3/member	3" from each end and at the centerline of each horizontal frame member	5/16" diameter weep hole

5.8 Sealants Used
Table 5.5 provides a summary of the sealants used in each test specimen.

Table 5.5: Sealant Details

Elevation #	Location	Sealant Description
3 & 3A	Perimeter Sealant	Tremco® Spectrem 2® silicone sealant
3 & 3A	Frame Joint Sealant	Tremco® Spectrem 2® silicone sealant
3 & 3A	Glazing Sealant	Dow Corning® 995 Silicone Structural Glazing Sealant

6.0 PRODUCT INSTALLATION

Table 6.1 provides a detailed summary of the product installation into the steel opening. The rough opening allowed for a 1" shim space.

Table 6.1: Product Installation Details

Elevation #	Location	Description	Installation	
			Test Opening	Frame member
All	Jambs	"F" anchor (Part # E1-3004)	Two (2), 3/8-16 x 1" HH bolts	Slide in
All	Intermediate Mullions	"T" anchor (Part # E1-3003)	Two (2), 3/8-16 x 1" HH bolts	Slide in

7.0 TEST SEQUENCE

Table 7.1 provides a summary of the test sequence for each test specimen tested.

Table 7.1: Test Sequence

Test Specimen 3	Test Specimen 3A
1. Air Infiltration Test	1. Positive Pre-Load
2. Positive Pre-Load	2. Positive Design Load
3. Positive Design Load	3. Positive Overload
4. Negative Pre-Load	4. Negative Pre-Load
5. Negative Design Load	5. Negative Design Load
6. Water Infiltration Test	6. Negative Overload
7. Positive Overload	7. Large Missile Impact
8. Negative Overload	8. Positive Cyclic Load
9. Large Missile Impact	9. Negative Cyclic Load
10. Positive Cyclic Load	
11. Negative Cyclic Load	

8.0 TEST RESULTS

8.1 Air Infiltration Test

8.1.1 Results – Air Infiltration Test

Table 8.1 provides the test results of the air infiltration test.

Table 8.1: Air Infiltration Test Results

Specimen #	Test Pressure (psf)	Measured (cfm/ft^2)	Allowed (cfm/ft^2)
3	+1.57	0.01	0.40
	+6.24	0.03	0.40

8.1.2 Conclusion – Air Infiltration Test

HTL observed a measured air infiltration less than the allowed air infiltration through the test specimen; as such, this test specimen satisfies the requirements of ASTM E283 and TAS 202.

8.2 Water Infiltration Test

8.2.1 Results – Water Infiltration Test

Table 8.2 provides the results for the water infiltration test conducted per the requirements of ASTM E331 and TAS 202.

Table 8.2: Water Infiltration Test Results

Specimen #	Test Pressure (psf)	Spray Rate (gph/ft^2)	Test Duration (minutes)	Conclusion
3	20	5	15	No Entry

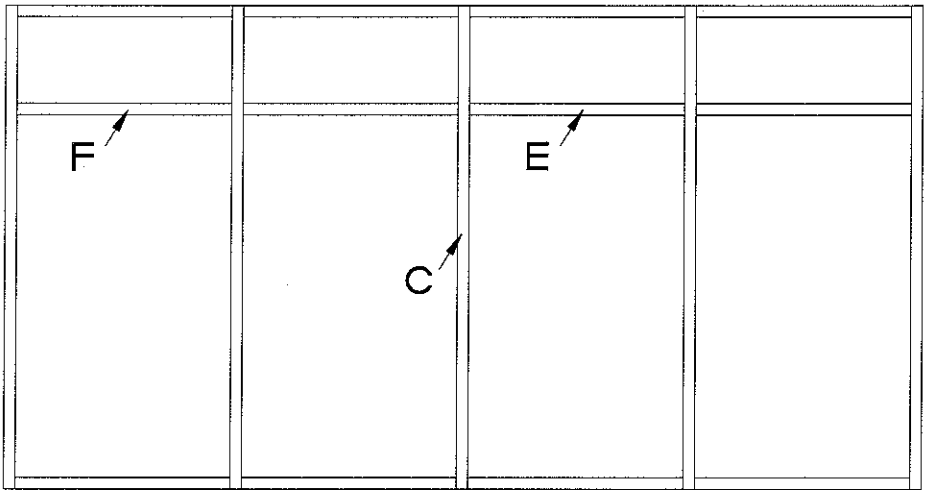
8.2.2 Conclusion – Water Infiltration Test

HTL observed zero (0) water infiltration through this test specimen; as such, these test specimens satisfy the requirements of ASTM E331 and TAS 202.

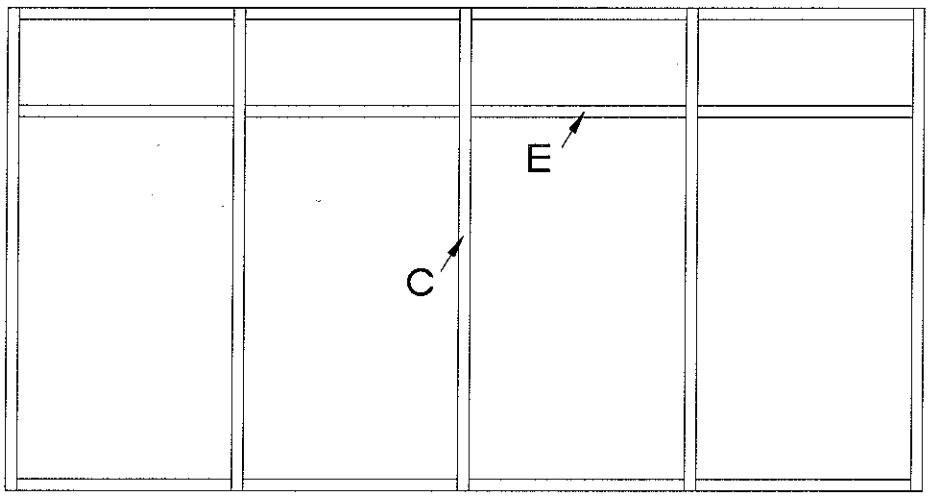
8.3 Uniform Static Load Test

8.3.1 Deflection Gage Locations

Figure 8.1 shows the deflection gage locations for the uniform static load test.



Specimen 3



Specimen 3A

Figure 8.1: Deflection Gage Locations
Uniform Static Load Test

8.3.2 Positive Load Test Results

Table 8.3 provides the positive uniform static load test results for the deflection gage locations shown in Section 8.3.1. The deflection reported is the overall deflection between three points (longest unsupported span) which accounts for support movement.

Table 8.3: Positive Uniform Static Load Test Results

Specimen #	Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)	
			Measured	Allowed	Measured	Allowed
3	C	+48.75	0.27	n/a	0.00	0.25
		+65.00	0.36	0.70	0.01	
		+97.50	0.57	n/a	0.02	
	E	+48.75	0.01	n/a	0.00	0.12
		+65.00	0.01	0.33	0.00	
		+97.50	0.02	n/a	0.00	
	F	+48.75	0.04	n/a	0.01	0.12
		+65.00	0.05	0.33	0.00	
		+97.50	0.07	n/a	0.01	
3A	C	+48.75	0.24	n/a	0.01	0.25
		+65.00	0.37	0.70	0.01	
		+97.50	0.57	n/a	0.02	
3A	E	+48.75	0.05	n/a	0.01	0.12
		+65.00	0.03	0.33	0.00	
		+97.50	0.06	n/a	0.01	

8.3.3 Negative Uniform Static Load Test Results

Table 8.4 provides the negative uniform static load test results for the locations presented in Section 8.3.1.

Table 8.4: Negative Uniform Static Load Test Results

Specimen #	Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)	
			Measured	Allowed	Measured	Allowed
3	C	-48.75	0.36	n/a	0.01	0.25
		-65.00	0.45	0.70	0.01	
		-97.50	0.54	n/a	0.01	
	E	-48.75	0.07	n/a	0.00	0.12
		-65.00	0.00	0.33	0.00	
		-97.50	0.03	n/a	0.02	
	F	-48.75	0.11	n/a	0.00	0.12
		-65.00	0.05	0.33	0.00	
		-97.50	0.14	n/a	0.06	

Table 8.4 (continued): Negative Uniform Static Load Test Results

Specimen #	Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)	
			Measured	Allowed	Measured	Allowed
3A	C	-48.75	0.24	n/a	0.01	0.25
		-65.00	0.35	0.70	0.03	
		-97.50	0.56	n/a	0.04	
	E	-48.75	0.02	n/a	0.00	0.12
		-65.00	0.02	0.33	0.00	
		-97.50	0.04	n/a	0.00	

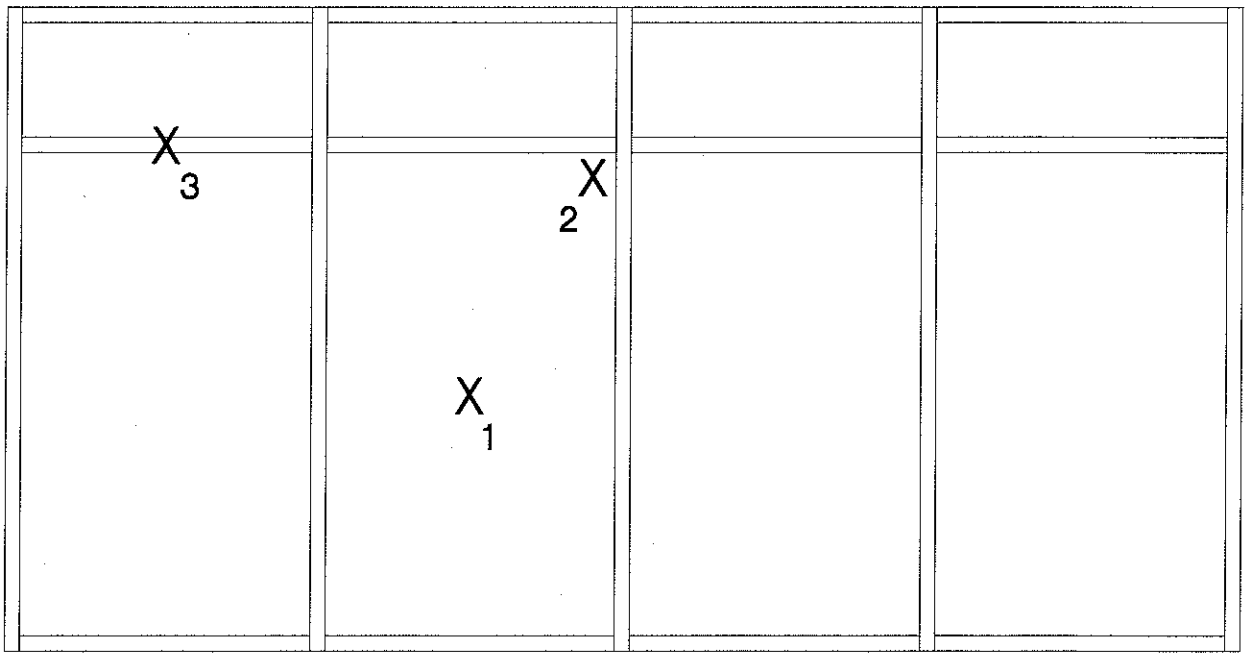
8.3.4 Conclusion – Uniform Static Load Test

HTL observed no signs of failure in any area of these test specimens during the uniform static load test. In addition, each specimen met the deflection and permanent set requirements; as such, these test specimens satisfy the uniform static load test requirements of ASTM E330 and TAS 202.

8.4 Large Missile Impact Test

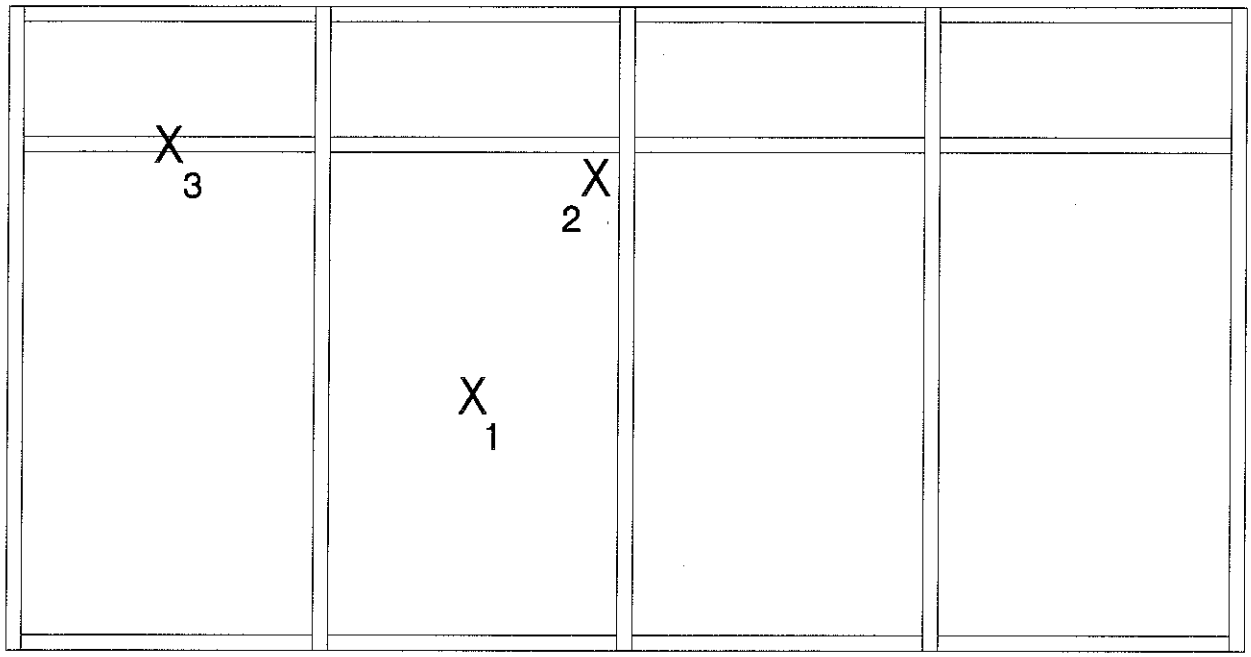
8.4.1 Large Missile Impact Locations

Figures 8.2 and 8.3 show the large missile impact locations for the specimens tested.



X- Large Missile Location

Figure 8.2: Large Missile Impact Locations - Specimen 3



X- Large Missile Location

Figure 8.3: Large Missile Impact Locations - Specimen 3A

8.4.2 Test Results - Large Missile Impact Test

Table 8.5 provides the large missile impact test results.

Table 8.5: Large Missile Impact Test Results

Specimen #	Impact #	Missile Weight (lbs.)	Missile Length (in.)	Missile Velocity (ft/sec)	Glass Temp. (°F)	X Coord.[1] (in.)	Y Coord.[2] (in.)
3	1	9.13	96	49.08	68	90.00	50.00
	2			49.66		114.00	93.00
	3			49.90		30.00	96.00
3A	1	9.00	97	52.91	66	91.00	49.00
	2			51.73		115.00	92.00
	3			49.22		32.00	97.00

[1]Measured from the left side of test specimen.
[2]Measured from the bottom of test specimen.

8.4.3 Conclusion - Large Missile Impact Test

The large missile impacted the intended targets and HTL carefully inspected each impact location. HTL observed no signs of penetration, rupture, or opening after the large missile impact test; as such, these test specimen satisfy the large missile requirements of the Florida Building Code TAS 201 and ASTM E1886/1996 Level D.

8.5 Cyclic Load Test

8.5.1 Deflection Gage Locations - Cyclic Load Test

Figure 8.1 shows the deflection gage locations for the cyclic load test. Please refer to Section 8.3.1 for figure 8.1.

8.5.2 Test Spectrum - Cyclic Load Test

Tables 8.6 and 8.7 provide the positive and negative cyclic load test spectrum respectively.

Table 8.6: Positive Load Test Spectrum

Stage	1	2	3	4
Pressure Range (psf)	13.0 – 32.5	0 – 39.0	32.5 – 52.0	19.5 – 65.0
Number of Cycles	3500	300	600	100

Table 8.7: Negative Load Test Spectrum

Stage	5	6	7	8
Pressure Range (psf)	19.5 – 65.0	32.5 – 52.0	0 – 39.0	13.0 – 32.5
Number of Cycles	50	1050	50	3350

8.5.3 Deflection Results - Cyclic Load Test

Table 8.8 shows the cyclic test results for each test specimen.

Table 8.8: Cyclic Load Test Results

Spec. #	Gage Loc.	Inward (Positive Load) Permanent Set		Outward (Negative Load) Permanent Set	
		Measured (in.)	Allowed (in.)	Measured (in.)	Allowed (in.)
3	C	0.13	0.25	0.18	0.25
	E	0.00	0.12	0.06	0.12
3A	C	0.13	0.25	0.13	0.25
	E	0.06	0.12	0.09	0.12

8.5.4 Conclusion - Cyclic Load Test

Upon completion of the cyclic load test, HTL carefully inspected the test specimens for failures. Glass types "A and AI" failed cycling because of tears in the glass. They were boarded up to pass the mullions and the other glass types. HTL observed no other signs of failure; as such, these test specimens satisfy the cyclic load test requirements of TAS 203 and ASTM E1886/1996.

9.0 SUMMARY

Table 9.1 provides a summary of the test results for YKK AP America's YHC 300.

Table 9.1: Summary of Test Results

Specimen #	Test Method	Test Conditions	Test Conclusion
3	Air Infiltration Test (TAS 202 and ASTM E283)	1.57 and 6.24 psf	PASS
3	Water Infiltration Test (TAS 202 and ASTM E331)	20 psf	PASS
3 & 3A	Static Load Test (TAS 202 and ASTM E330)	+/- 65 psf Design Pressure	PASS
3 & 3A	Large Missile Impact Test (TAS 201, ASTM E1886/E1996)	--	PASS
3 & 3A	Cyclic Load Test (TAS 203 and ASTM E1886/E1996)	+/- 65 psf Design Pressure	PASS (Glass Type "D and DI" only)

10.0 CERTIFICATION AND DISCLAIMER STATEMENT

All tests performed on these test specimens were conducted in accordance with the specifications of the applicable codes, standards and test methods listed below by HTL, LLC. HTL, LLC does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested at HTL. HTL is not owned, operated or controlled by any company manufacturing or distributing products it tests. This report is only intended for the use of the entity named in Section 1.0 of this report. Detailed assembly drawings showing wall thickness of all members, corner construction and hardware applications are on file and have been compared to the test specimens submitted. A copy of this test report along with representative sections of the test specimens will be retained at HTL for a period of three (3) years. All results obtained apply only to the specimens tested and they do indicate compliance with the performance requirements of the test methods and specifications listed in the following section.

ENGINEER OF RECORD

11/2/2009

REPORT WRITER

11/2/2009

11.0 APPLICABLE CODES, STANDARDS, AND TEST METHODS

Florida Building Code TAS 201-94 - Impact Test Procedures
Florida Building Code TAS 202-94 – Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components using Uniform Static Air Pressure
Florida Building Code TAS 203-94 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading
ASTM E283-04 – Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330-02 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331-00 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1886-05 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996-09 – Standard Specification for performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

12.0 WITNESSES (ALL OR PARTIAL)

Vinu J. Abraham, P.E.	CEO	HTL, LLC
Jose Colon, E.I.	Operations Manager	HTL Georgia
Ian McKenzie	Lab Supervisor	HTL Georgia
Kevin Gardner	Test Team	HTL Georgia
Robert Kott	Support Team	HTL Georgia

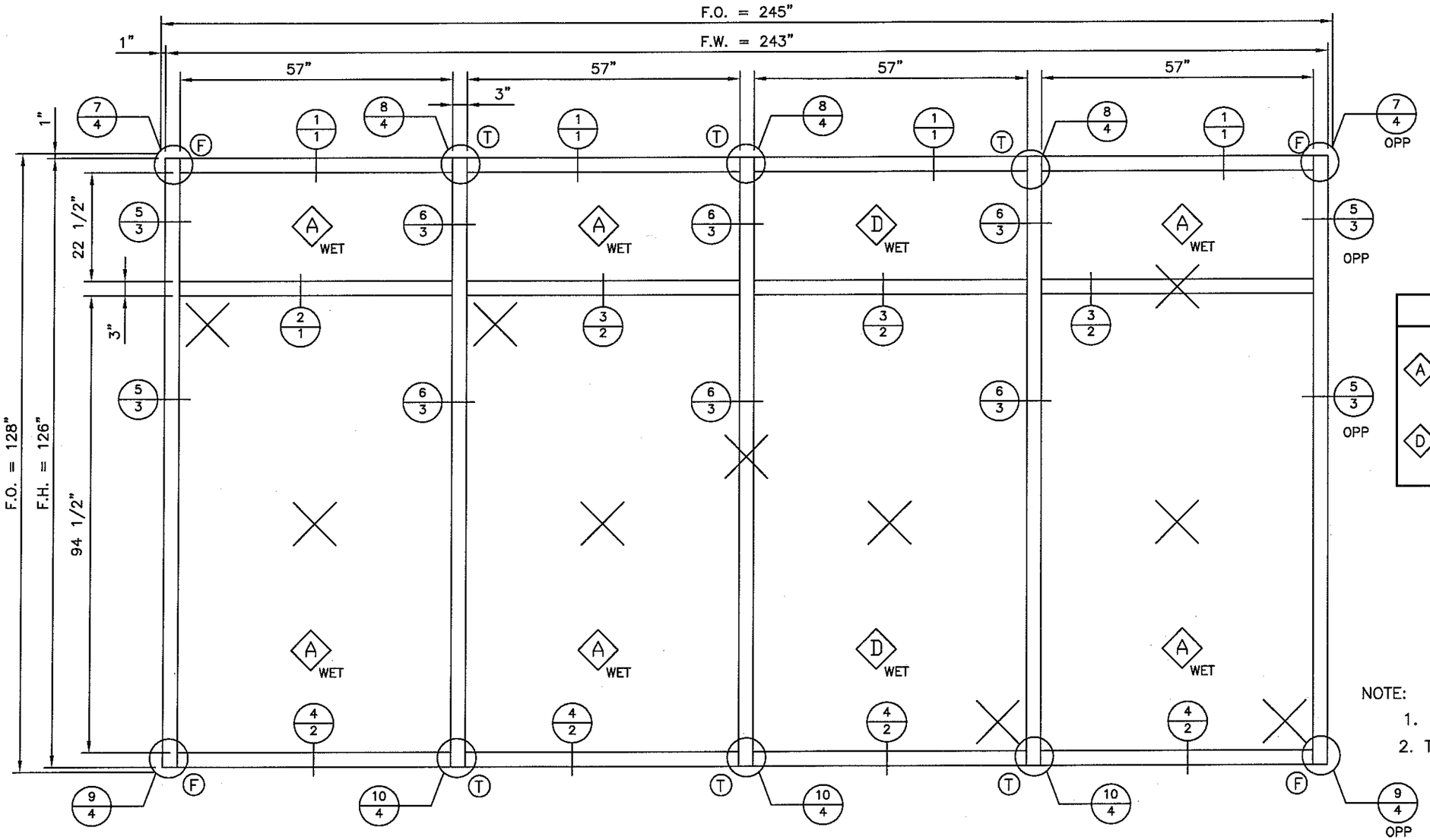
ENGINEER OF RECORD

11/2/2009

REPORT WRITER

11/2/2009

REV.	DESCRIPTION	BY	DATE



GLASS TYPE

A — 9/16" 0.090 BUTACITE (L.M.):
1/4" HEAT STRENGTHENED GLASS +
0.090" BUTACITE (PVB) +
1/4" HEAT STRENGTHENED GLASS

D — 9/16" SENTRYGLASS: (L.M.)
1/4" HEAT STRENGTHENED GLASS +
0.090" SENTRYGLASS +
1/4" HEAT STRENGTHENED GLASS

HTL

AS TESTED UNLESS OTHERWISE NOTED
DATE 10-30-2009
JOB# G231-1001-09

NOTE:
1. DESIGN PRESSURE LOAD = 65psf.
2. TEST TO PERFORM = TAS 201-94
TAS 202-94 (FULL)
TAS 203-94

ELEVATION 3
(1) req'd
SCALE 1/2" = 1'-0"

IMPACT LOCATION LEGEND

X LARGE MISSILE IMPACT LOCATION
⊗ SMALL MISSILE IMPACT LOCATION

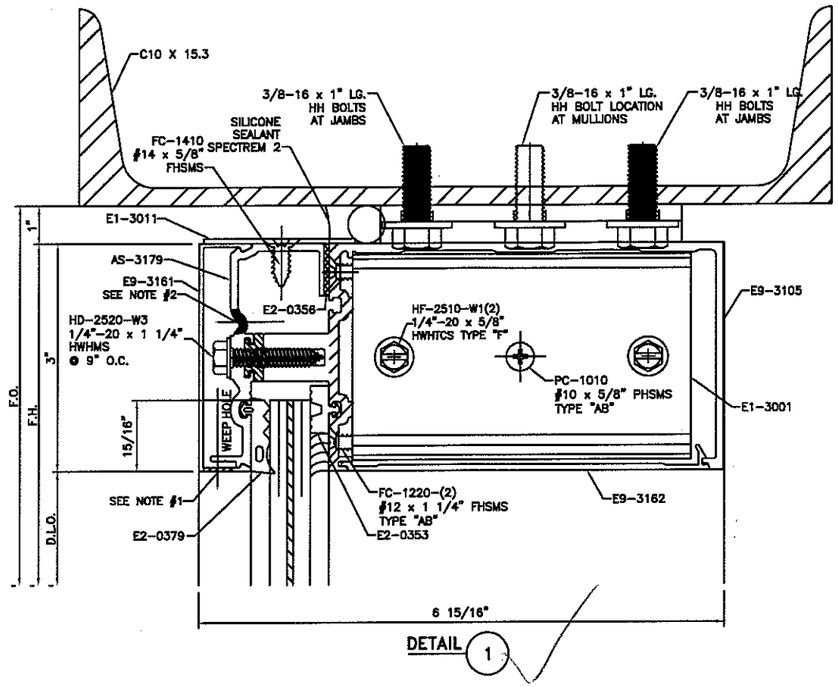
ANCHOR TYPE

(F): 'F' ANCHOR
(T): 'T' ANCHOR

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT	SCALE: AS NOTED
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: ELEV-3	
APPROVED BY: RB / DRAWN BY: DO / DATE: 06/17/09	SHEET NO. 3

REV.	DESCRIPTION	BY	DATE



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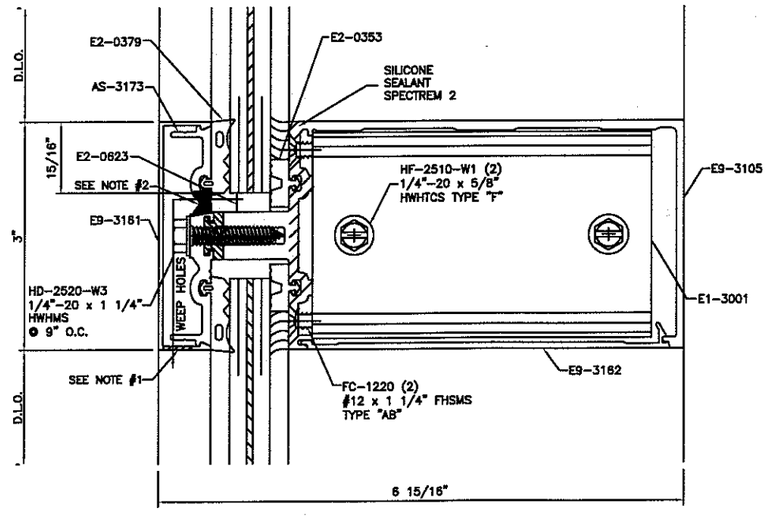


DETAIL 2

NOTES:

1. 5/16" DIA. WEEP HOLE (2) PER HORIZONTAL COVER LOCATED @ 1/3 POINTS
2. 5/16" DIA. WEEP HOLE (3) PER HORIZONTAL, 3" FROM EACH END, & ONE IN THE CENTER.

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-3	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/17/09	1

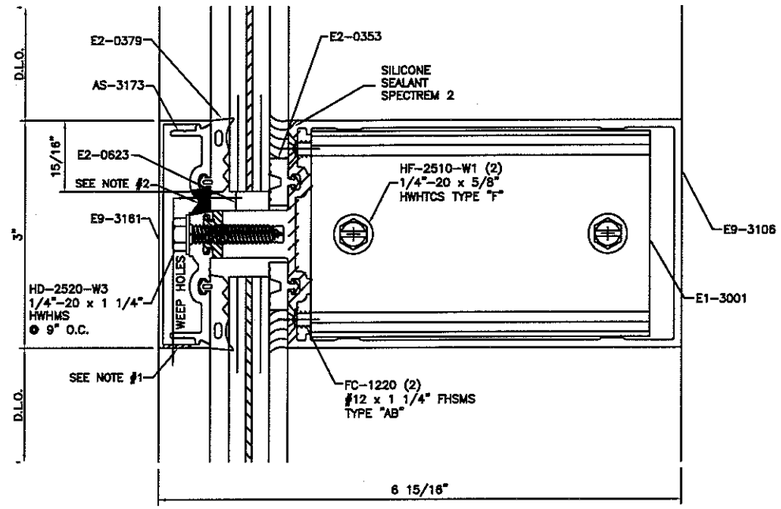
REV.	DESCRIPTION	BY	DATE

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09



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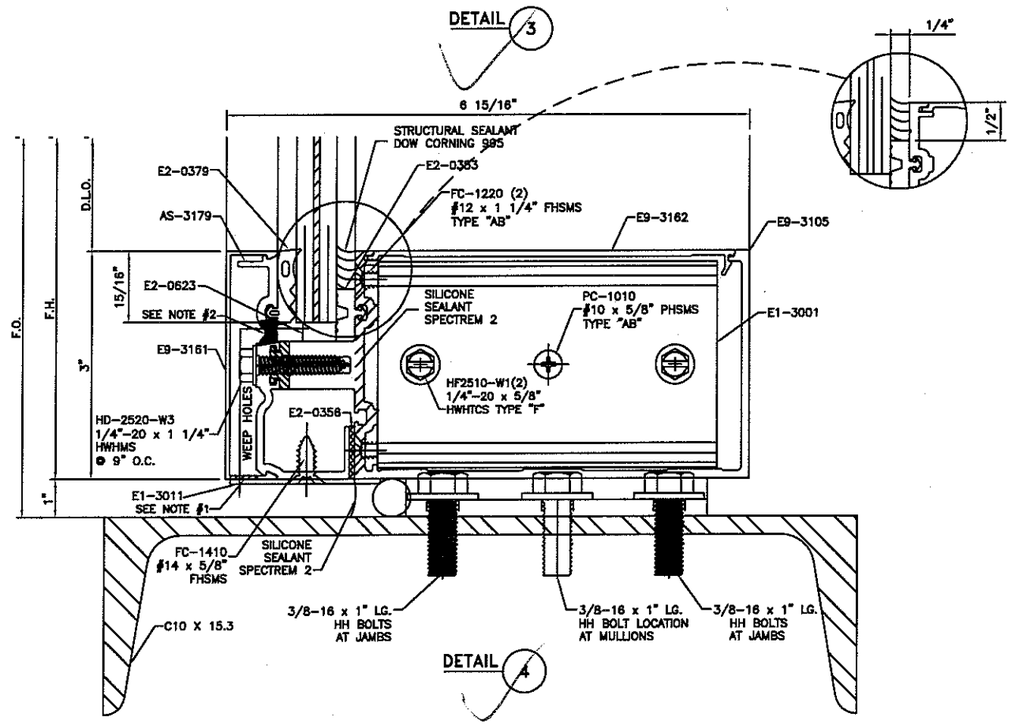


DETAIL 4

NOTES:

1. 5/16" DIA. WEEP HOLE (2) PER HORIZONTAL COVER LOCATED @ 1/3 POINTS
2. 5/16" DIA. WEEP HOLE (3) PER HORIZONTAL, 3" FROM EACH END, & ONE IN THE CENTER.

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-3	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/17/09	2

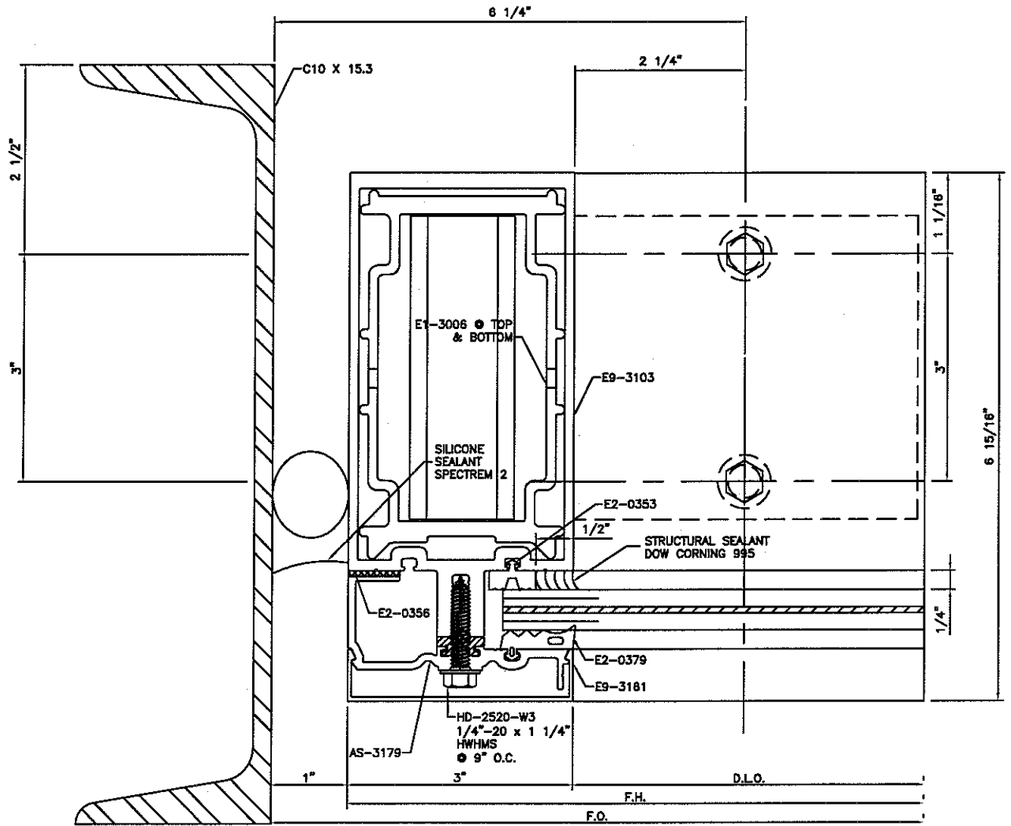
REV.	DESCRIPTION	BY	DATE

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09



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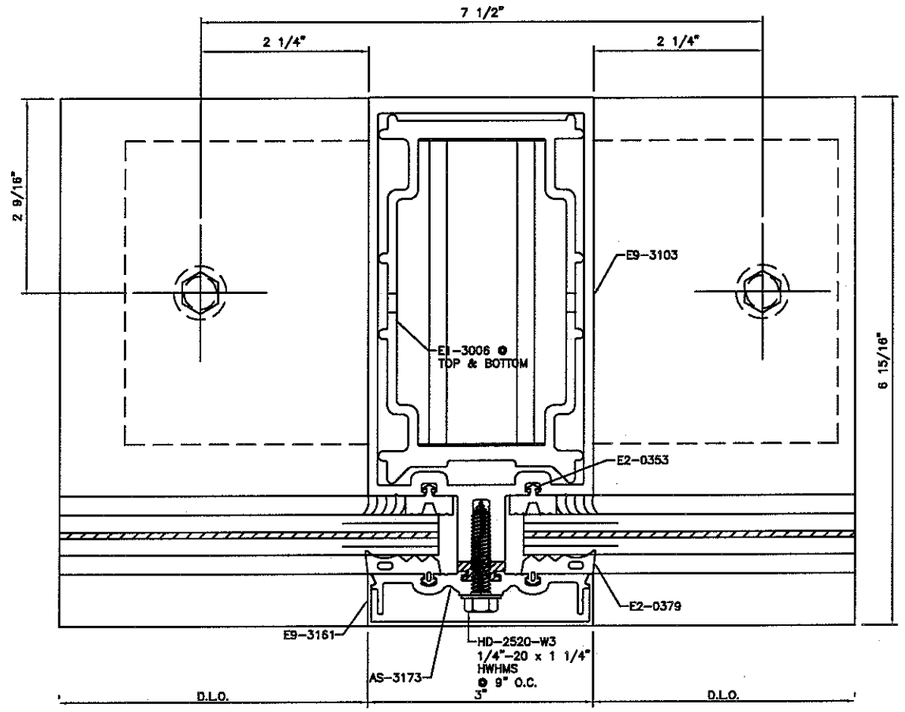
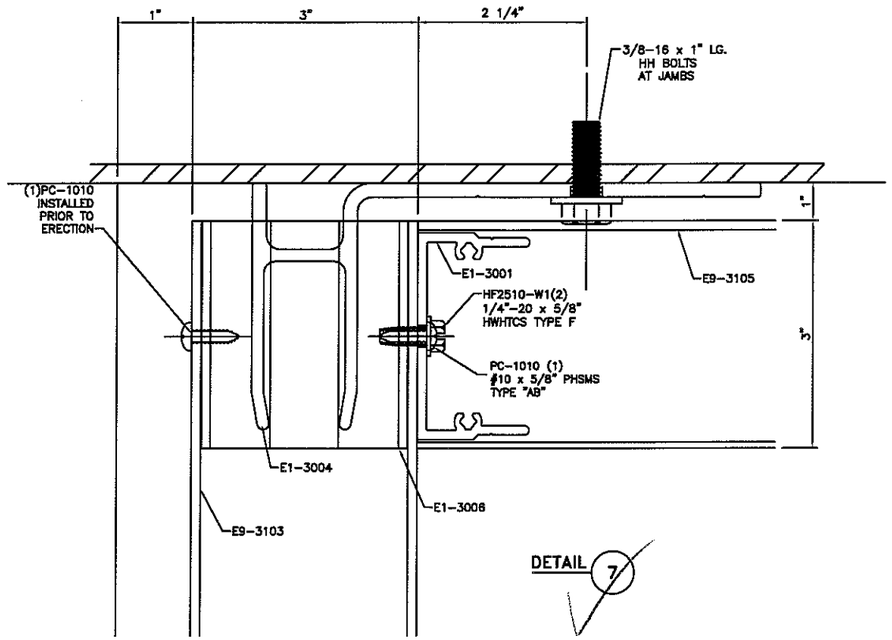


DETAIL 6

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT			SCALE: HALF
			GLAZING
DESCRIPTION: FORMAL MOCK-UP TEST			
FINISH: PAINTED			
DRAWING NUMBER: DET-3			
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/17/09	SHEET NO.: 3

REV.	DESCRIPTION	BY	DATE



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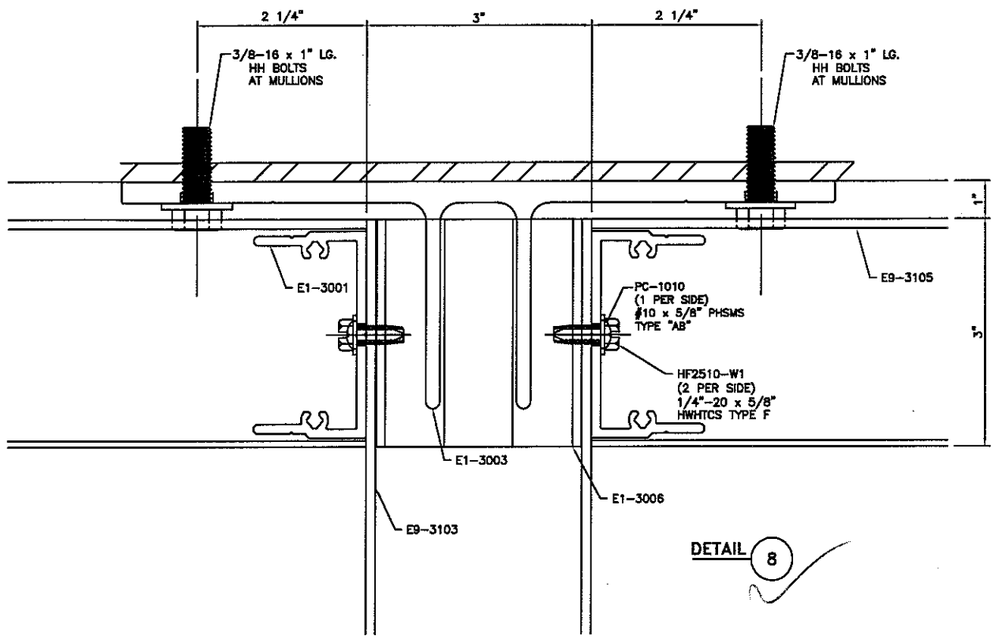

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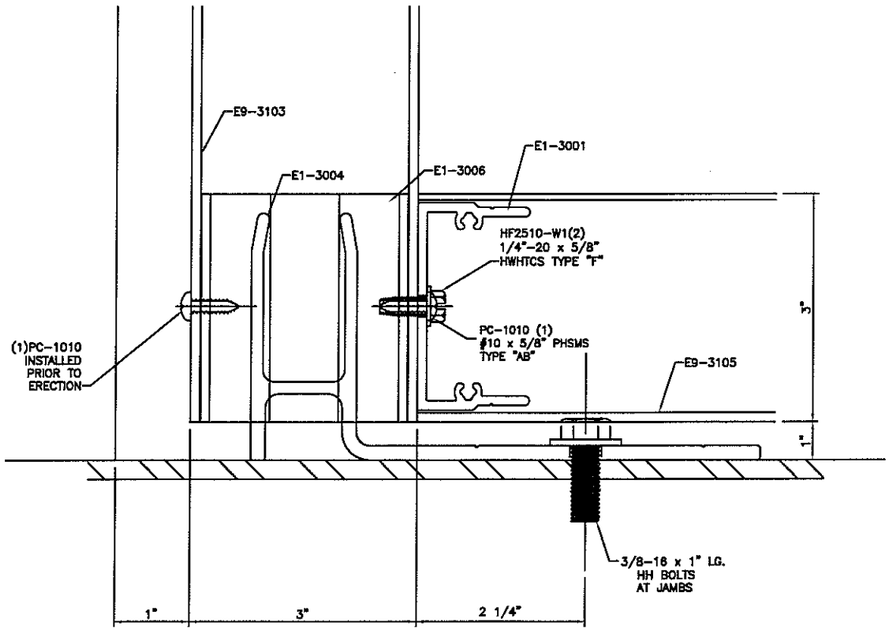

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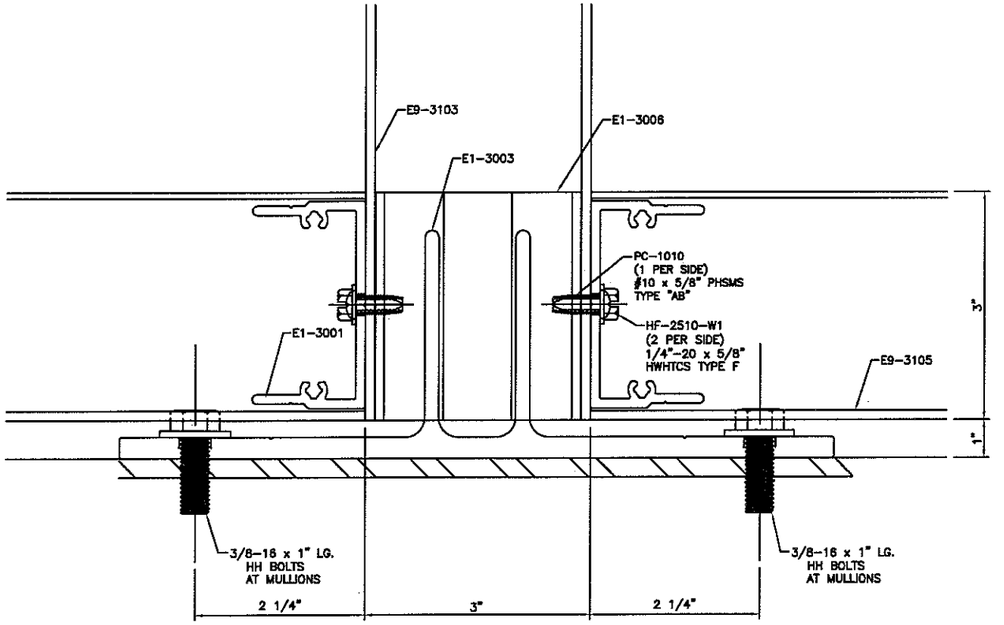


DETAIL 10

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

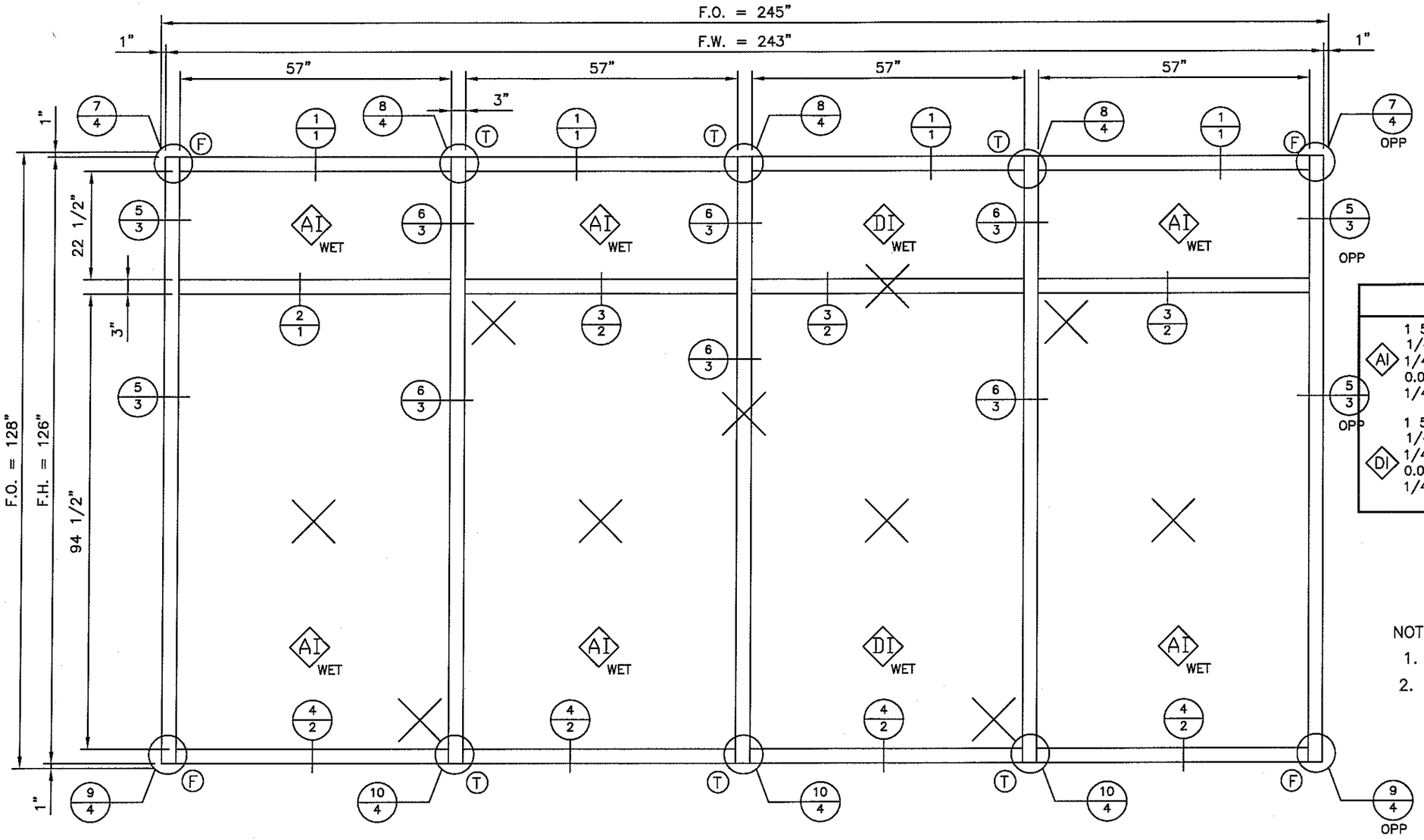
JOB# G231-1001-09

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT	SCALE: HALF; GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-3	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/17/09	4

REV.	DESCRIPTION	BY	DATE



AS TESTED UNLESS OTHERWISE NOTED
DATE 10-30-2009
JOB# G231-1001-09

GLASS TYPE

AI: 1 5/16" 0.090 BUTACITE(L.M.):
1/4" TEMPERED GLASS + 1/2" AIR SPACE +
1/4" HEAT STRENGTHENED GLASS +
0.090" BUTACITE (PVB) +
1/4" HEAT STRENGTHENED GLASS

DI: 1 5/16" SENTRYGLASS: (L.M.)
1/4" TEMPERED GLASS + 1/2" AIR SPACE +
1/4" HEAT STRENGTHENED GLASS +
0.090" SENTRYGLASS +
1/4" HEAT STRENGTHENED GLASS

NOTE:
1. DESIGN PRESSURE LOAD = 65psf.
2. TEST TO PERFORM = TAS 201-94
TAS 202-94 (Str. only)
TAS 203-94

ELEVATION 3A
(1) req'd
SCALE 1/2" = 1'-0"

IMPACT LOCATION LEGEND
X LARGE MISSILE IMPACT LOCATION
⊗ SMALL MISSILE IMPACT LOCATION

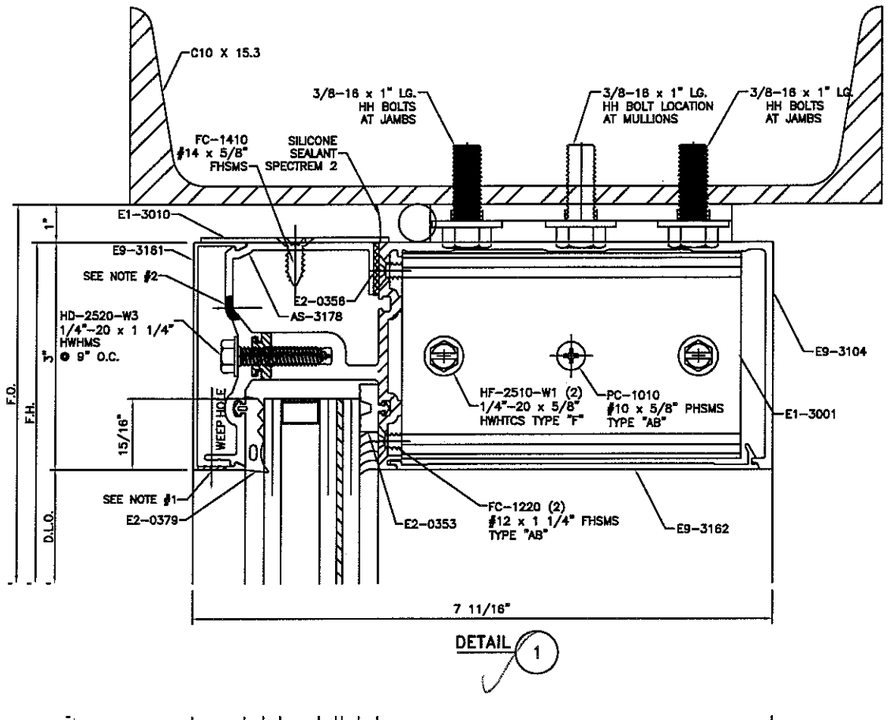
ANCHOR TYPE

Ⓕ: 'F' ANCHOR
Ⓣ: 'T' ANCHOR

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT	SCALE: AS NOTED
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: ELEV-3A	
APPROVED BY: RB / DRAWN BY: DO / DATE: 06/17/09	SHEET NO: 3A

REV.	DESCRIPTION	BY	DATE



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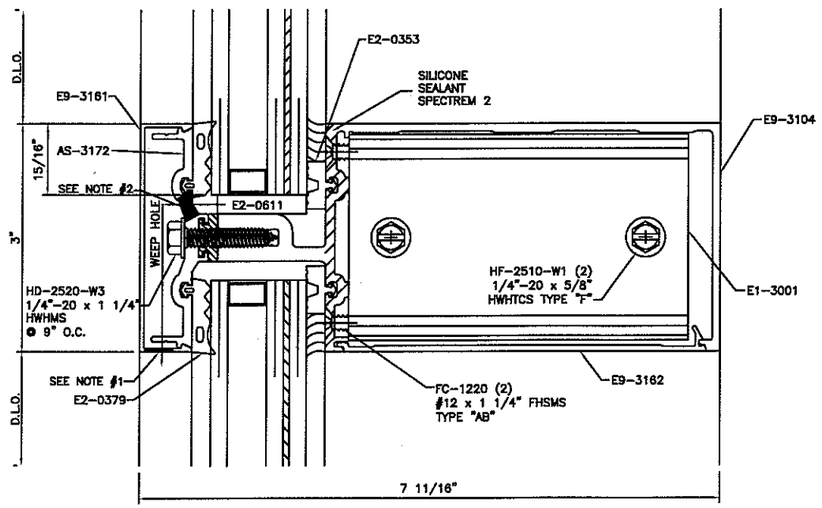


DETAIL 2

NOTES:

1. 5/16" DIA. WEEP HOLE (2) PER HORIZONTAL COVER LOCATED @ 1/3 POINTS
2. 5/16" DIA. WEEP HOLE (3) PER HORIZONTAL, 3" FROM EACH END, & ONE IN THE CENTER.

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

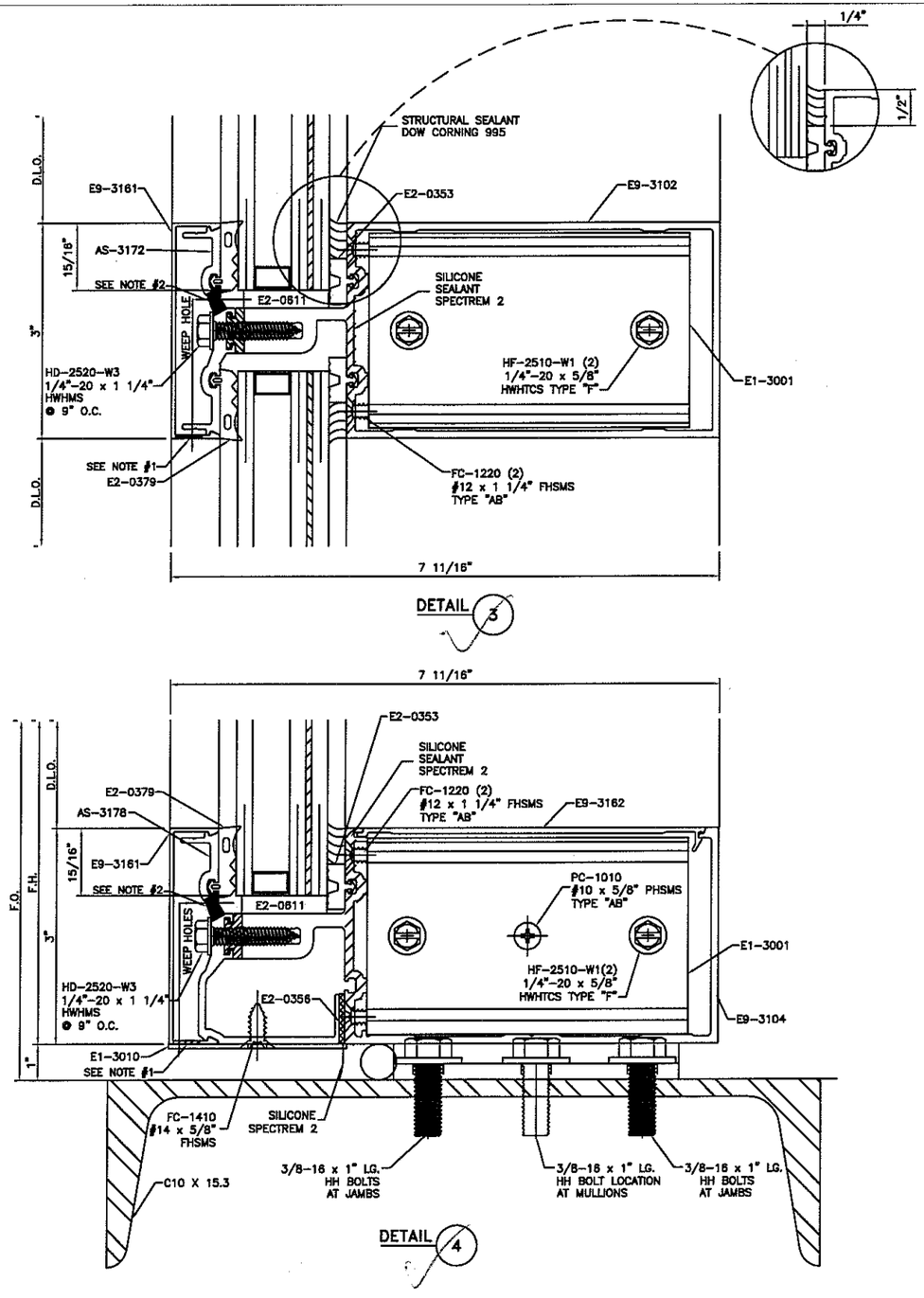
JOB# G231-1001-09

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-3A	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/17/09	1

REV.	DESCRIPTION	BY	DATE



HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09

NOTES:

1. 5/16" DIA. WEEP HOLE (2) PER HORIZONTAL COVER LOCATED @ 1/3 POINTS
2. 5/16" DIA. WEEP HOLE (3) PER HORIZONTAL, 3" FROM EACH END, & ONE IN THE CENTER.

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT	SCALE: HALF
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: DET-3A	

APPROVED BY	DRAWN BY	DATE	SHEET NO.
RB	DO	06/17/09	2

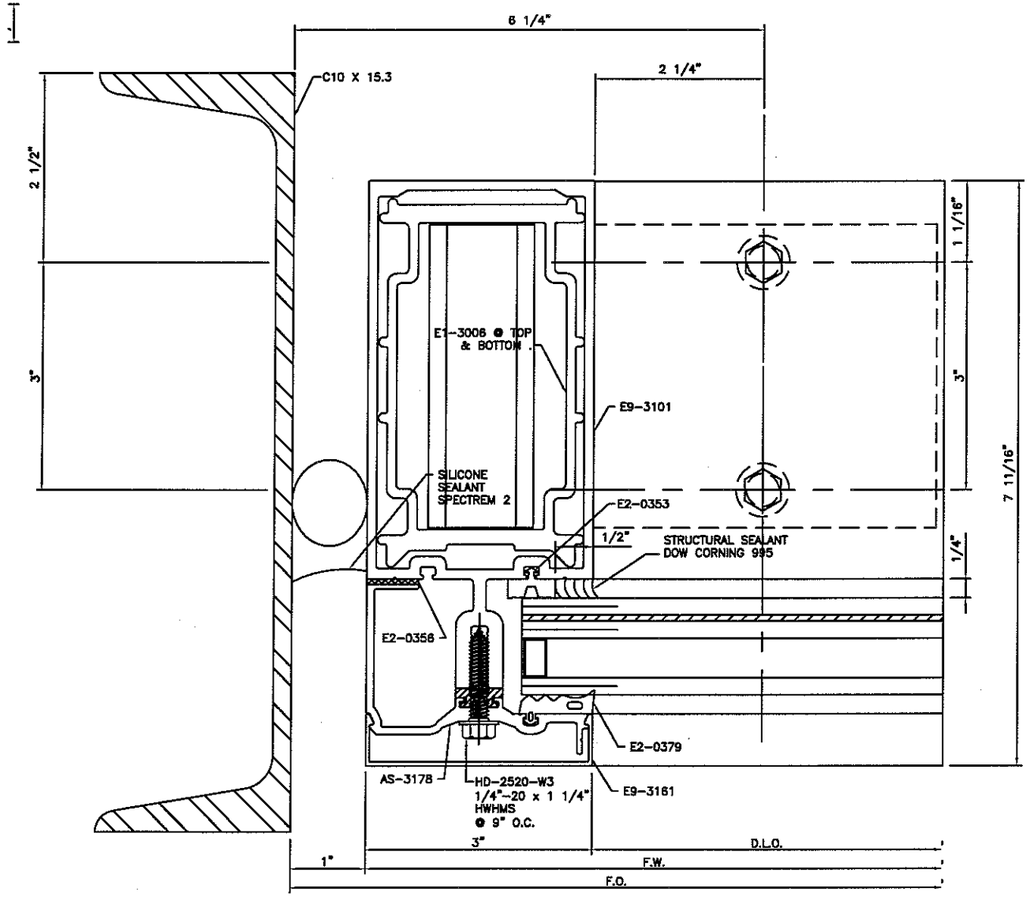
REV.	DESCRIPTION	BY	DATE

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB#. G231-1001-09



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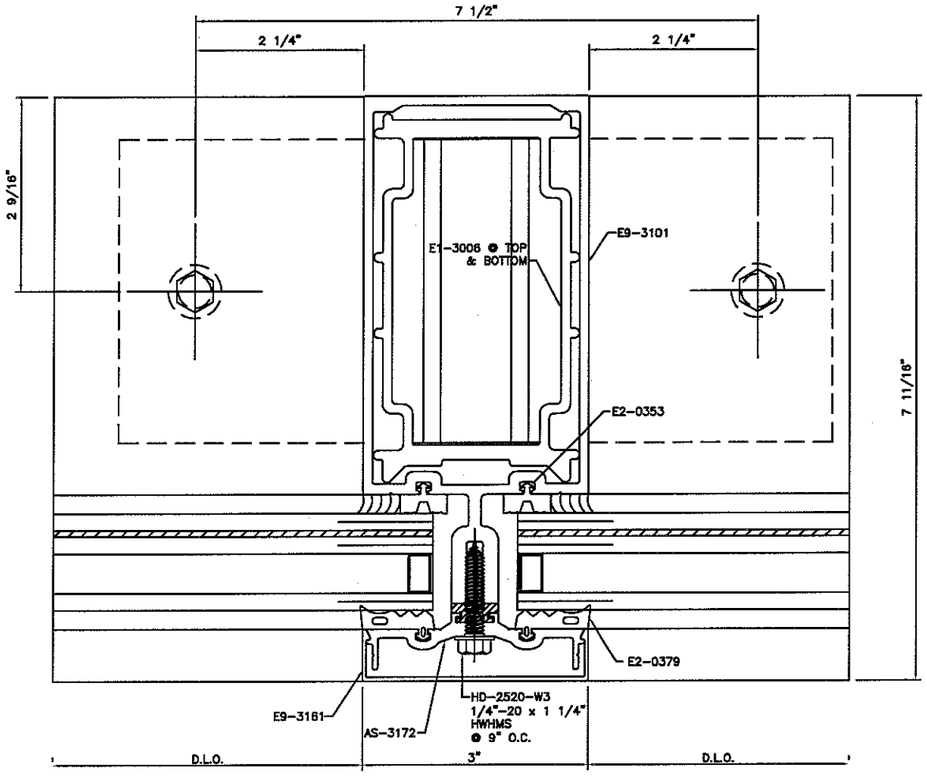
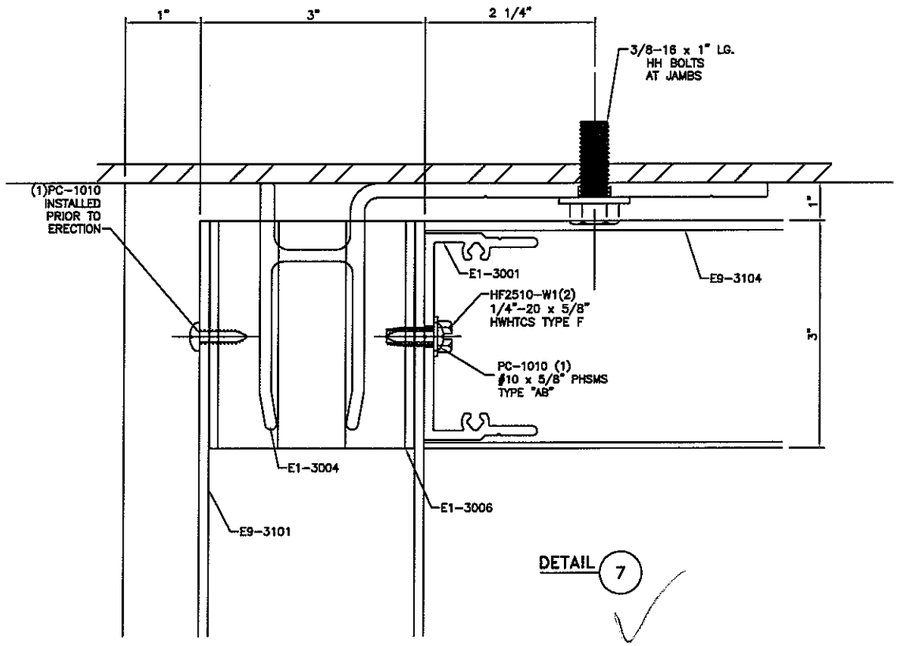


DETAIL 6

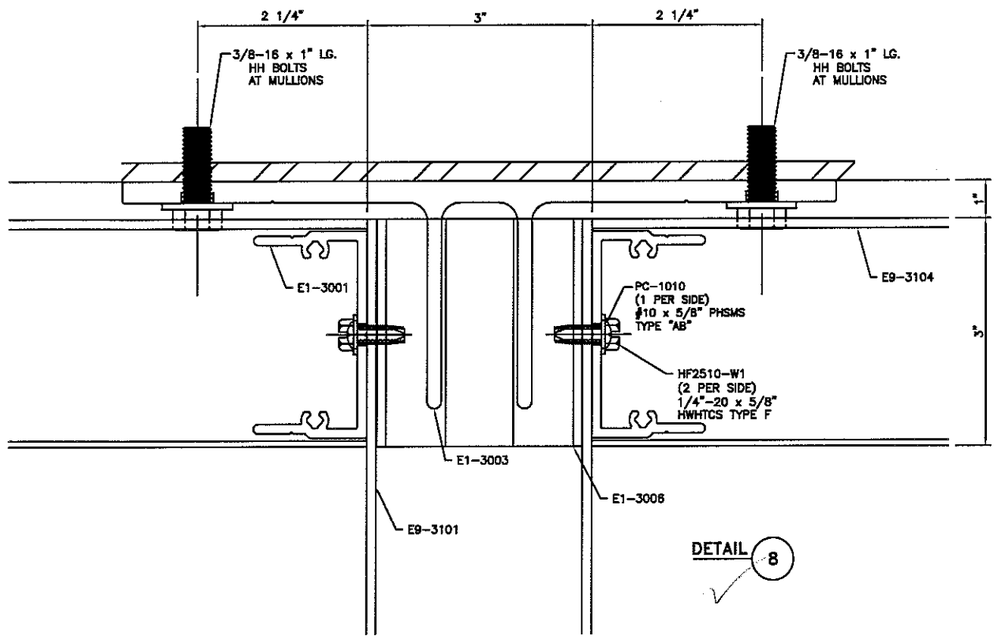
YKK AP

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT			SCALE: HALF
			GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST			
FINISH: PAINTED			
DRAWING NUMBER: DET-3A			
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/17/09	SHEET NO: 3

REV.	DESCRIPTION	BY	DATE



DETAIL 7



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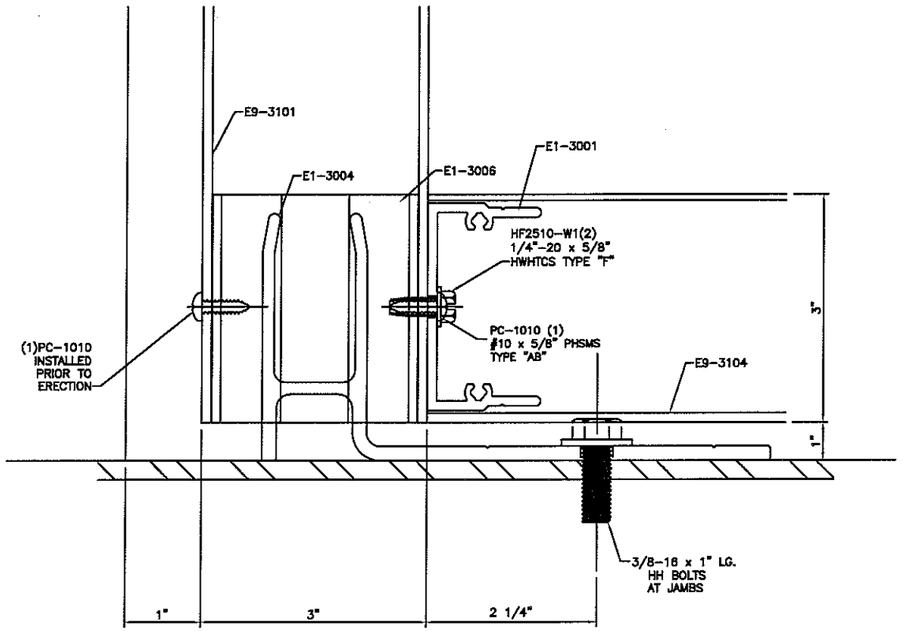

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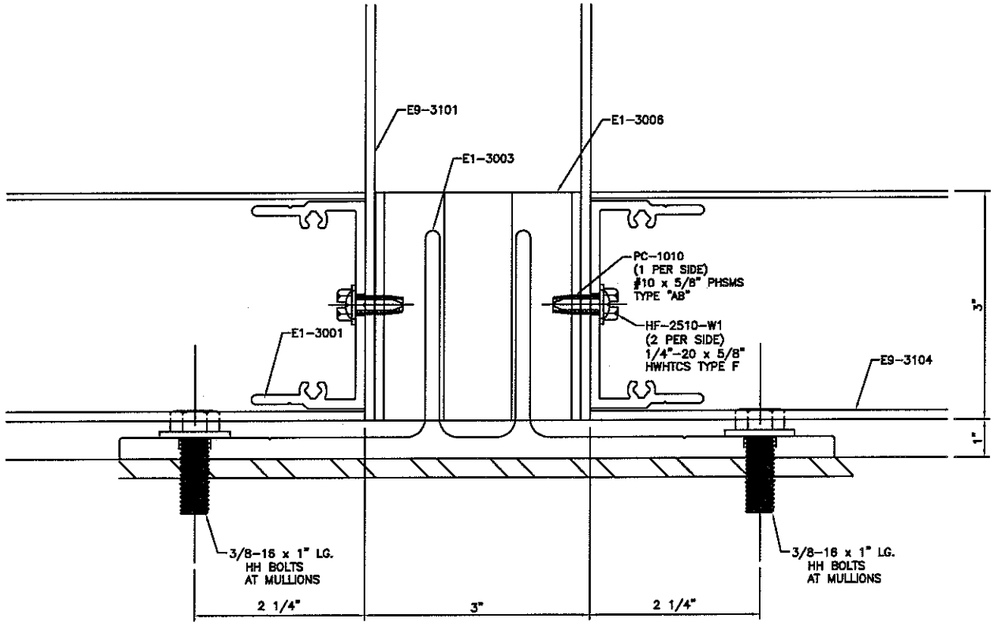


DETAIL 10

HTL

AS TESTED UNLESS OTHERWISE NOTED

DATE 10-30-2009

JOB# G231-1001-09

YKK ap

SYSTEM: YHC 300 O.G. (65 p.s.f.) STANDARD NO REINFORCEMENT		SCALE: HALF; GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST		
FINISH: PAINTED		
DRAWING NUMBER: DET-3A		
APPROVED BY: RB	DRAWN BY: DO	DATE: 06/17/09; SHEET NO.: 4

TEST REPORT

Report No.: F3753.02-550-18

Rendered to:

YKK AP AMERICA, INC
Austell, Georgia

PRODUCT TYPE: Curtain Wall
SERIES/MODEL: YHC 300 OG – Elevation 2

Title	Summary of Results
Design Pressure	±2633 Pa (±55.00 psf)
Uniform Load Structural Test Pressure	±3950 Pa (±82.50 psf)
Large Missile Test	Pass

Reference must be made to Report No. F3753.02-550-18, dated 04/21/16 for complete test specimen description and detailed test results.

1.0 Report Issued To: YKK AP America, Inc.
270 Riverside Parkway, Suite A
Austell, Georgia 30168
Don Pangburn

2.0 Test Laboratory: Architectural Testing, Inc.,
an Intertek company ("Intertek-ATI")
1701 Westfork Drive, Suite 106
Lithia Springs, Georgia 30122
770-941-6916

3.0 Project Summary:

3.1 Product Type: Curtain Wall

3.2 Series/Model: YHC 300 OG – Elevation 2

3.3 Compliance Statement: Results obtained are tested values and were secured by using the designated test method(s). Test specimen description and results are reported herein.

3.4 Test Date(s): 03/15/16 – 03/16/16

3.5 Test Record Retention End Date: All test records for this report will be retained until March 16, 2020.

3.6 Test Location: Intertek-ATI test facility in Lithia Springs, Georgia.

3.7 Test Specimen Source: The test specimen was provided by the client. Representative samples of the test specimen(s) will be retained by Intertek-ATI for a minimum of four years from the test completion date.

3.8 Drawing Reference: The test specimen drawings have been reviewed by Intertek-ATI and are representative of the test specimen(s) reported herein. Test specimen construction was verified by Intertek-ATI per the drawings located in Appendix C. Any deviations are documented herein or on the drawings.

3.9 List of Official Observers:

Name	Company
Don Pangburn	YKK AP America, Inc.
Shane Tanner	YKK AP America, Inc.
Jon Gardner	Intertek-ATI
Darrell Lewis	Intertek-ATI
Ian McKenzie	Intertek-ATI
Jacques Johnson	Intertek-ATI

4.0 Test Method(s):

ASTM E330/E330M-14, *Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*

ASTM E1886-13a, *Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials*

ASTM E1996-14a, *Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes*

5.0 Test Specimen Description:

5.1 Product Sizes:

Overall Area: 14.8 m² (158.83 ft²)	**Width**		**Height**	
	millimeters	**inches**	**millimeters**	**inches**
Overall size	4,648	183	2,515	99

5.2 Frame Construction:

Frame Member	**Material**	**Description**
Head/Sill	Aluminum 6063-T5	Part #E9-3127 (Middle and Right Bays), #E9-3112 (Left Bay)
Head/Sill Filler		Part #E9-8169
Jambs/Mullions		Part #E9-3126
Head/Sill/Jamb Pressure Plate		Part #AS-3178
Mullion Pressure Plate		Part #AS-3172
Pressure Plate Cover		Part #E9-3161

Location	**Joinery Type**	**Detail**
Intermediate mullions at head and sill	Square cut and butted	Part #HF2510-W1 (two per side) 1/4"-20 x 5/8" HMHTCS Type F
Top and bottom corners	Square cut and butted	Part #HF2510-W1 (two side by side connecting head and sill to the jambs).

5.0 Test Specimen Description: (Continued)

5.3 Reinforcement: Reinforcement was not utilized.

5.4 Weatherstripping:

Description	Quantity	Location
Pressure Plate Gasket (Part #E2-0379)	13 rows	Faces of the mullion and pressure plates

5.5 Glazing: *No conclusions of any kind regarding the adequacy or inadequacy of the glass in any glazed test specimen(s) can be made.*

Glass Type	Overall Thickness	Glass Makeup	Glazing Method
GI	1-5/16"	1/4" tempered glass 1/2" air space 1/4"heat-strengthened glass 0.060" (Saflex - PVB) interlayer 1/4" heat-strengthened glass	Exterior Dry-Glazing – Pressure Plate (Part #AS-3172) with gasket (Part #E2-0379 Interior Dry Glazing – Gasket (Part # E20379)
CI	1-5/16"	1/4" tempered glass 1/2" air space 1/4"heat-strengthened glass 0.060" (SentryGlass) interlayer 1/4" heat-strengthened glass	Exterior Dry-Glazing – Pressure Plate (Part #AS-3172) with gasket (Part #E2-0379 Interior Dry Glazing – Gasket (Part # E20379)

Glass Type	Location	Quantity	Daylight Opening		Glass Bite
			millimeters	inches	
CI	All lites	3	1448 x 2362	57 x 93	

5.6 Drainage: No drainage was utilized.

6.0 Installation:

The specimen was installed into a steel test buck. The rough opening allowed for a 1/2" shim space. The exterior perimeter of the window was sealed with structural sealant.

Location	Anchor Description	Anchor Location
Intermediate Mullions	Part #E1-3046	Head and sill of intermediate mullions attached to the steel with 3/8-16 x 1" LG HH Bolts
Top and bottom of jambs	Part #E1-3004	Head and sill of jambs anchored on the steel with two (2) 3/8-16 x 1" LG HH Bolts

7.0 Test Results: The temperature during testing was 25°C (77°F). The results are tabulated as follows:

Title of Test	Results	Allowed	Note
Uniform Load Deflection, ½ of Test Load per ASTM E330 Deflections taken at one intermediate mullion			
+1976 Pa (+41.25 psf)	5.6 mm (0.22")	14.0 mm (0.55") max.	
-1976 Pa (-41.25 psf)	6.6 mm (0.26")	14.0 mm (0.55") max.	1, 2
Uniform Load Structural, Design Load per ASTM E330 Deflections taken at one intermediate mullion			
+2635 Pa (+55.00 psf)	7.9 mm (0.31")	14.0 mm (0.55") max.	
-2635 Pa (-55.00 psf)	8.9 mm (0.35")	14.0 mm (0.55") max.	1, 2
Uniform Load Deflection, Test Load per ASTM E330 Permanent sets taken at one intermediate mullion			
+3952 Pa (+82.50 psf)	1.0 mm (0.04")	5.1 mm (0.20") max.	
-3952 Pa (-82.50 psf)	1.5 mm (0.06")	5.1 mm (0.20") max.	1, 2

7.0 Test Results: (Continued)

ASTM E1886 and ASTM E1996, *Large and Small Missile Impact*

Conditioning Temperature: 26.7°C (80°F)
Large Missile Weight: 4082g (9.0 lbs)
Large Missile Length: 2.5 m (8'4")
Small Missile Weight: 2g

Elevation 2: Orientation within ±5° of horizontal

Impact #1 (Small Missile): Missile Velocity: 40.1 m/s (131.5 fps)	
Impact Area:	Bottom of center lite at the midpoint
Observations:	Missile hit target area. No signs of penetration.
Results:	Pass

Impact #2 (Small Missile): Missile Velocity: 39.9 m/s (130.8 fps)	
Impact Area:	Geometric center of center lite
Observations:	Missile hit target area. No signs of penetration.
Results:	Pass

Impact #3 (Small Missile): Missile Velocity: 39.5 m/s (129.5 fps)	
Impact Area:	Top of center lite at the midpoint
Observations:	Missile hit target area. No signs of penetration.
Results:	Pass

Impact #4 (Large Missile): Missile Velocity: 15.4 m/s (50.4 fps)	
Impact Area:	Bottom right corner of left lite
Observations:	Missile hit target area. No signs of penetration.
Results:	Pass

Impact #5 (Large Missile): Missile Velocity: 15.2 m/s (49.8 fps)	
Impact Area:	Top right corner of right lite
Observations:	Missile hit target area. No signs of penetration.
Results:	Pass

***Note**: See Elevation 2 drawings for impact locations*

7.0 Test Results: (Continued)

Conclusion: The large and small missiles impacted each intended target and Intertek-ATI carefully inspected each impact location. Intertek-ATI observed no signs of penetration, rupture, or opening after the large missile impact test; as such, each test specimen satisfies the large and small requirements of ASTM E1886 and ASTM E1996.

ASTM E1886 and ASTM E1996, *Air Pressure Cycling*

Test Unit: Elevation 2
Design Pressure: ±2633 Pa (±55.0 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
527 to 1317 (11.0 to 27.5)	3500	2.6	No damage to the frame or deglazing of the glass
0 to 1580 (0 to 33.0)	300	2.9	
1317 to 2107 (27.5 to 44.0)	600	2.4	
790 to 2633 (16.5 to 55.0)	100	2.8	

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
790 to 2633 (16.5 to 55.0)	50	3.0	No damage to the frame or deglazing of the glass
1317 to 2107 (27.5 to 44.0)	1050	2.3	
0 to 1580 (0 to 33.0)	50	3.0	
527 to 1317 (11.0 to 27.5)	3350	2.6	

7.0 Test Results: (Continued)

***General Note**: All testing was performed in accordance with the referenced standard(s).*

Note 1: Loads were held for 30 seconds.

Note 2: Tape and film were used to seal against air leakage during structural testing.

8.0 Test Equipment:

Cannon: Constructed from steel piping utilizing compressed air to propel the missile

Missile: 2x4 Southern Pine and 8 mm (5/16") diameter ball bearings

Timing Device: Electronic Beam Type

Cycling Mechanism: Computer controlled centrifugal blower with electronic pressure measuring device

Deflection Measuring Device: Linear transducers

Intertek-ATI will service this report for the entire test record retention period. Test records such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained by Intertek-ATI for the entire test record retention period.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen(s) tested. This report may not be reproduced, except in full, without the written approval of Intertek-ATI.

For ARCHITECTURAL TESTING, INC.:

Digitally Signed by: Jacques Johnson

Jacques R. Johnson
Quality Manager

Digitally Signed by: Ian J. McKenzie

Ian J. McKenzie
Lab Manager - Regional Operations

JRJ:IJM:jab

Attachments (pages): This report is complete only when all attachments listed are included.

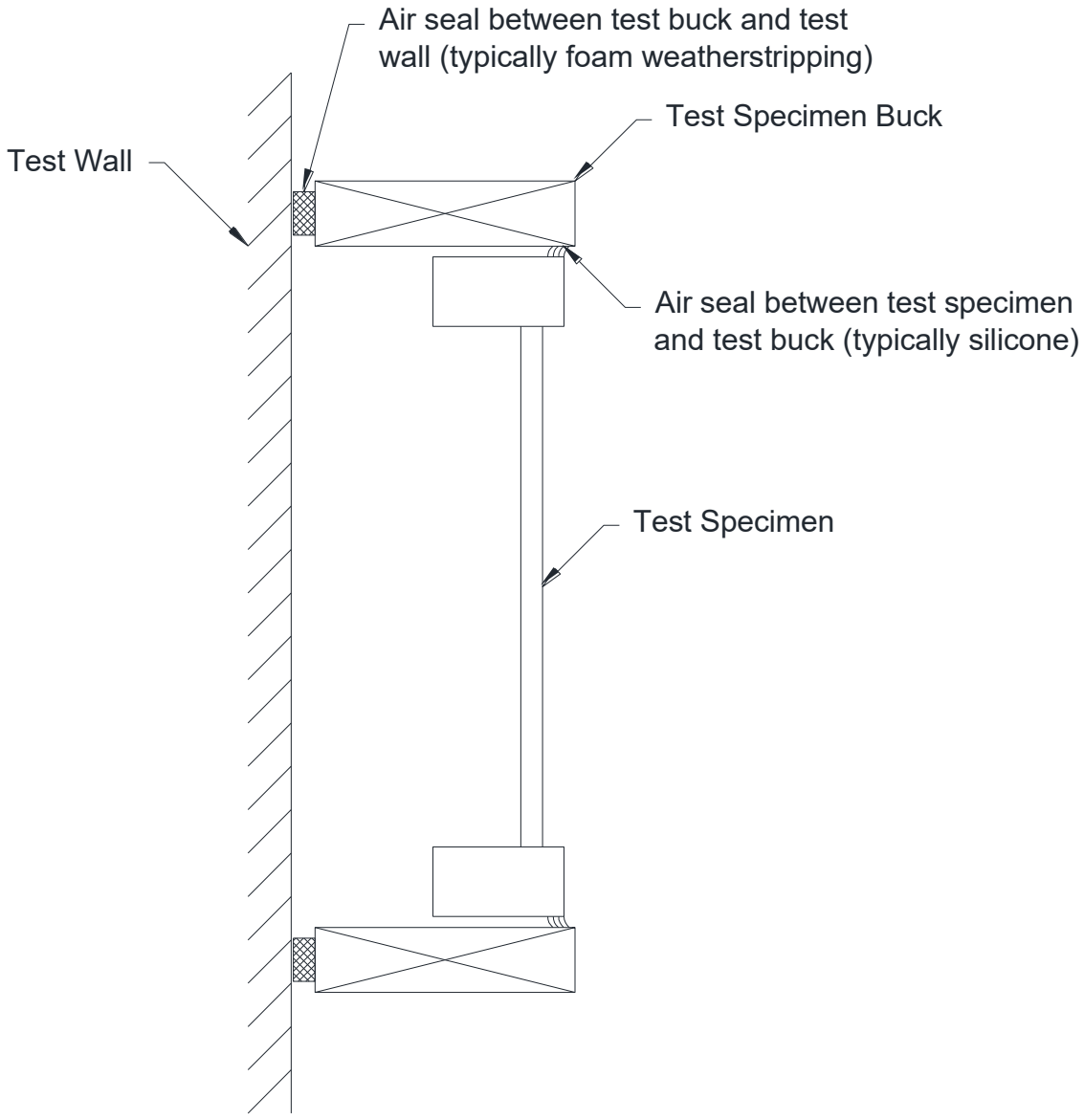
- Appendix A: Location of air seal (1)
- Appendix B: Photograph(s) (1)
- Appendix C: Drawings (5)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	04/11/16	N/A	Original report issue
1	04/15/16	Cover	Changed the cover page job number to reflect the job number in the header.
2	04/21/16	Drawings	Update drawings

Appendix A

Location of Air Seal: The air seal between the test specimen and the test wall is detailed below. The seal is made of foam weatherstripping and is attached to the edge of the test specimen buck. The test specimen buck is placed against the test wall and clamped in place, compressing the weatherstripping and creating a seal.



Appendix B

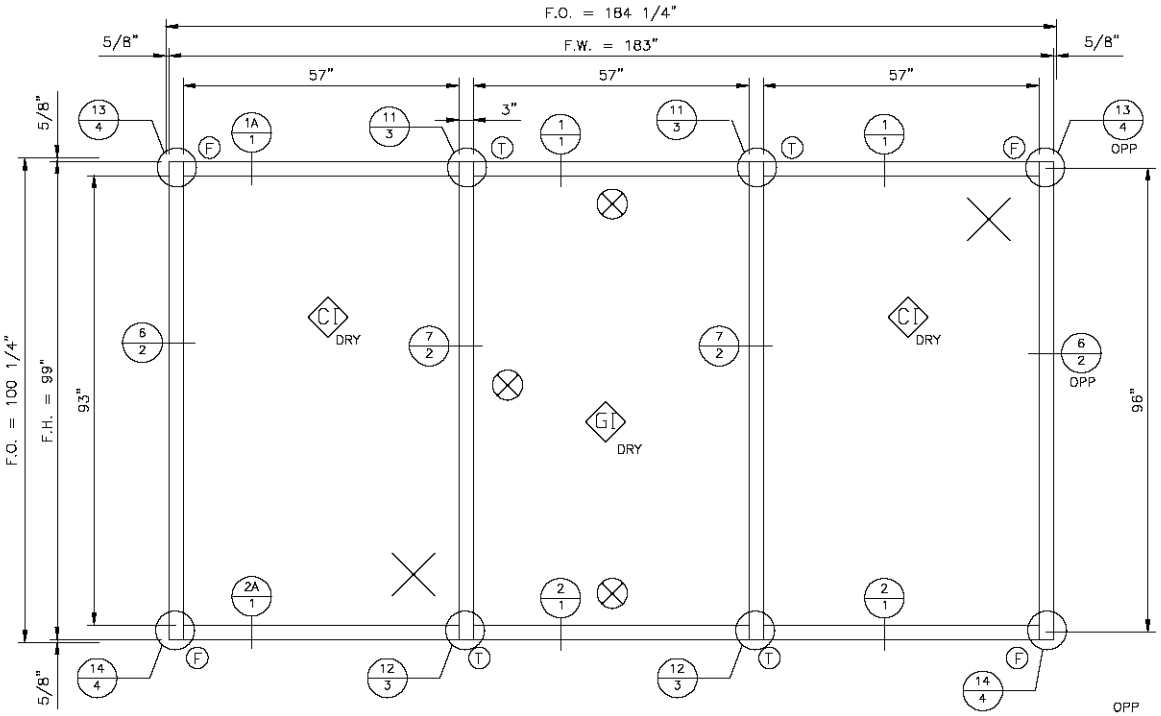
Photographs

Photo No. 1
Test Specimen After Large and Small Missile Impacts

Appendix C

Drawings

REV.	DESCRIPTION	BY	DATE



ELEVATION 2

FRAME OPENING WIDTH = 184 $\frac{1}{4}$"

FRAME OPENING HEIGHT = 100 $\frac{1}{4}$"

GLASS TYPE

GI 1 5/16" 0.060 SAFLEX: (S.M.)
1/4" HEAT STRENGTHENED GLASS +
0.060" SAFLEX (PVB) +
1/4" HEAT STRENGTHENED GLASS w/
1/ 2" AIR SPACE + 1/4" TEMPERED
GLASS

CI 1 5/16" 0.060 SENTRYGLASS: (LARGE MISSILE) (DRY GLAZED)
1/4" TEMPERED GLASS + 1/2" AIR SPACE +
1/4" HEAT STRENGTHENED GLASS + 0.060" SENTRYGLASS +
1/4" HEAT STRENGTHENED GLASS

NOTE:
1. DESIGN PRESSURE LOAD = 55psf.
2. STRUCTURAL ONLY, (NO AIR & WATER)

IMPACT LOCATION LEGEND

X LARGE MISSILE IMPACT LOCATION

⊗ SMALL MISSILE IMPACT LOCATION

ANCHOR TYPE

(F): 'F' ANCHOR

(T): 'T' ANCHOR

YKK ap

SYSTEM: YHC 300 O.G. (55 p.s.f.) SHALLOW MULLION	SCALE: AS NOTED
	GLAZING:
DESCRIPTION: FORMAL MOCK-UP TEST	
FINISH: PAINTED	
DRAWING NUMBER: ELEV-2	
APPROVED BY: DP / DRAWN BY: AA / DATE: 9/30/15	SHEET NO.: 2

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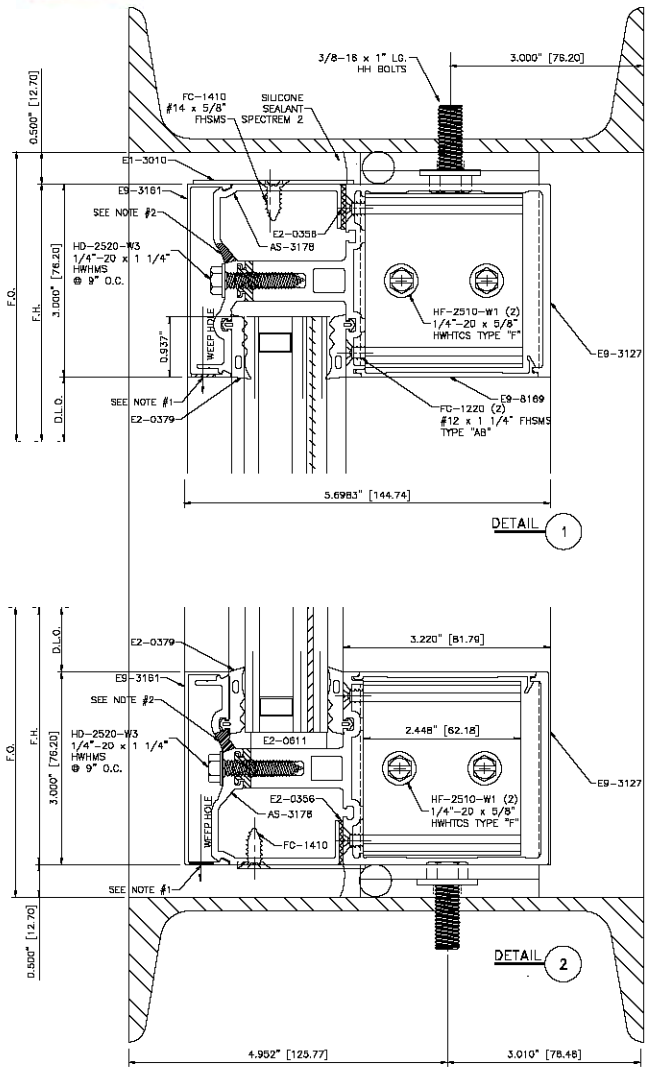

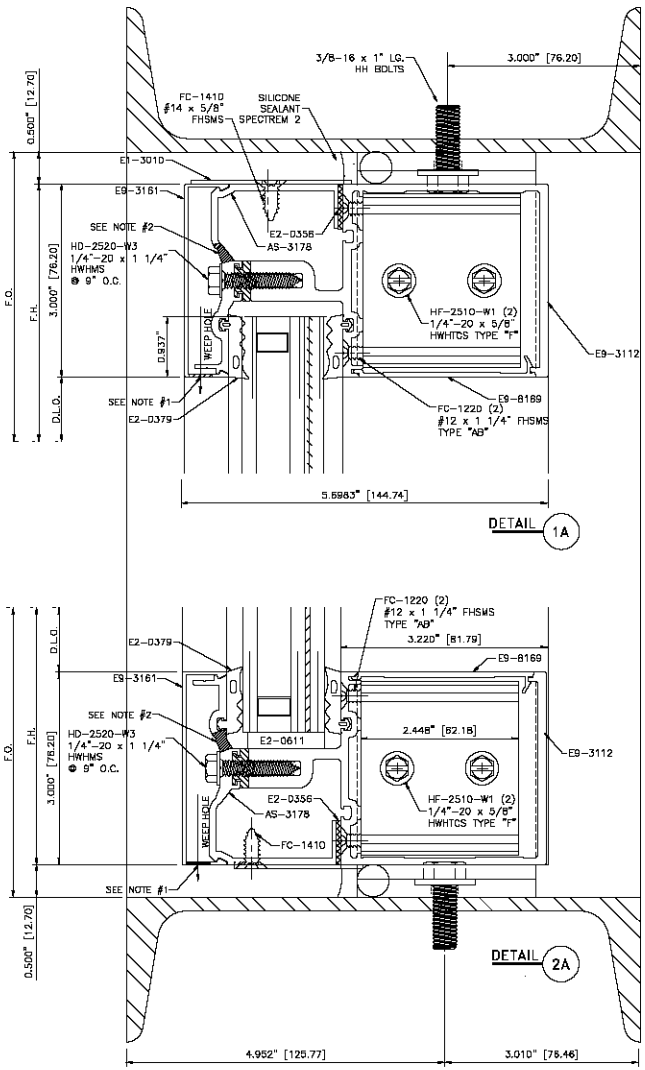

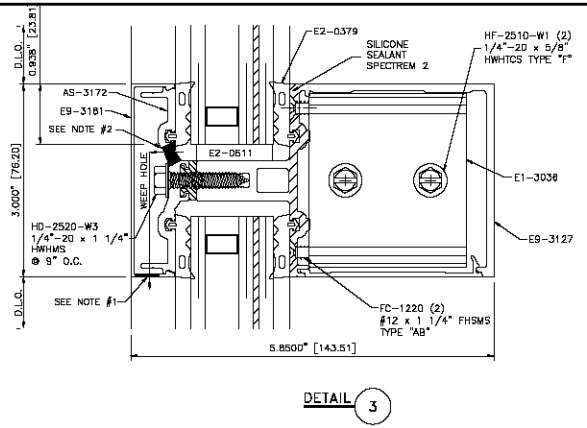

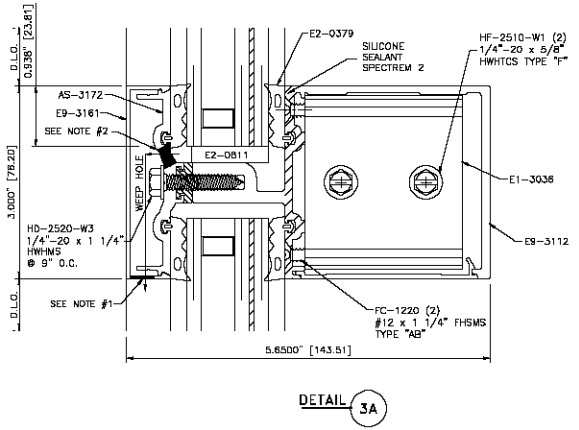

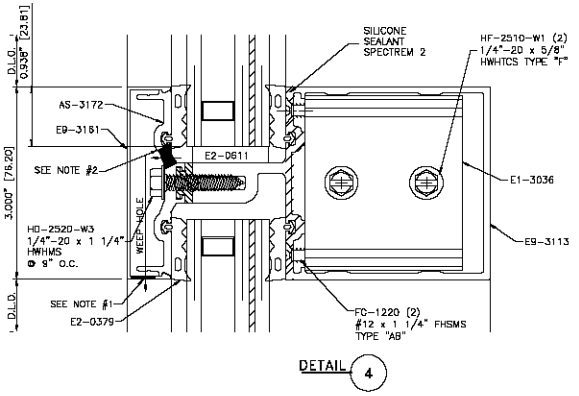

NOTE 1: 5/16" WEEP HOLES @ 1/3 PTS.

NOTE 2: 5/16" WEEP HOLES 3" FROM EACH END & (1) @ CENTER

YKK AP America Inc.
270 Riverside Parkway,
Suite A, Austell, GA 30168
(PH) 678.838.8000
(FAX) 678.838.8056

NO.	REVISION	ISSUE DATE	BY	CHD BY

ARCHITECT NAME AND LOCATION:

CUSTOMER NAME AND LOCATION:

PROJECT NAME AND LOCATION:
YHC300 DG
TEST NOCK UP
(SHALLOW MULLION)

DESCRIPTION:

SCALE:	ISSUE DATE:
As Noted	10/02/15
DRAWN BY: dp	SHEET NO.: 1
CHECKED BY:	

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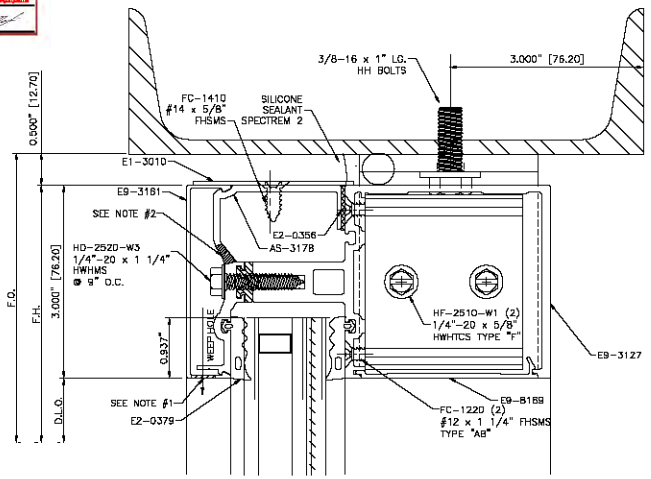

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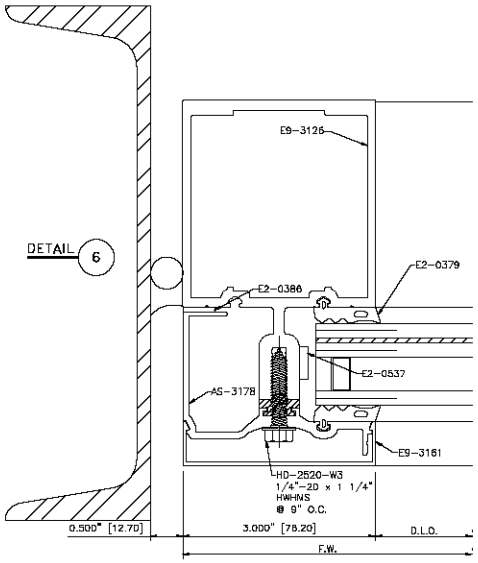

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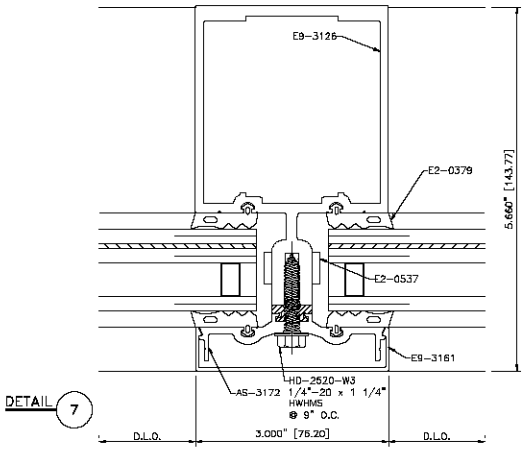

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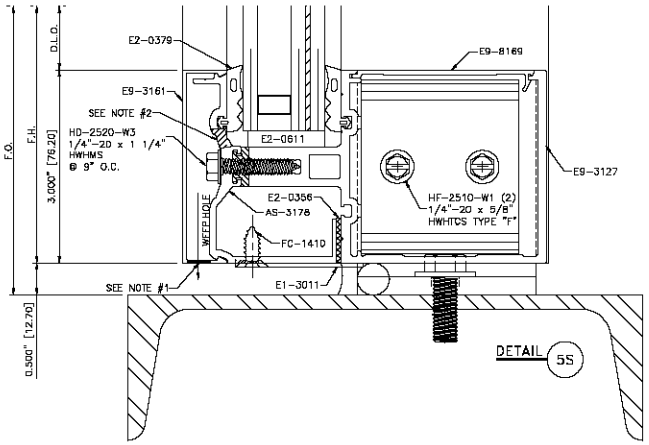

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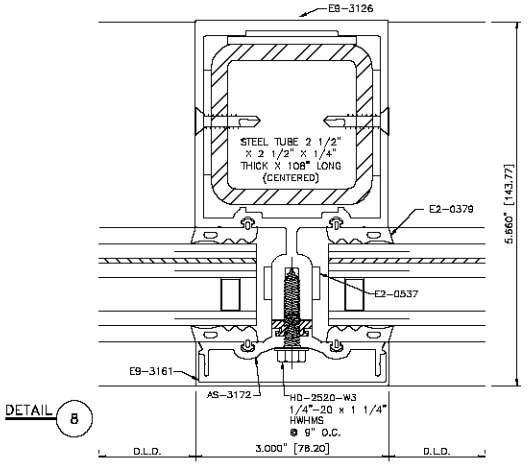

DETAIL 8

NOTE 1: 5/16" WEEP HOLES @ 1/3 PTS.

NOTE 2: 5/16" WEEP HOLES 3" FROM EACH END & (1) @ CENTER

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NO.	REVISION	ISSUE DATE	DWN BY

ARCHITECT NAME AND LOCATION:

CUSTOMER NAME AND LOCATION:

PROJECT NAME AND LOCATION:
YHC300 DG
TEST NOCK UP
(SHALLOW MULLION)

DESCRIPTION:

SCALE:	ISSUE DATE:
As Noted	10/02/15
DRAWN BY: dp	SHEET NO.: 2
CHECKED BY:	

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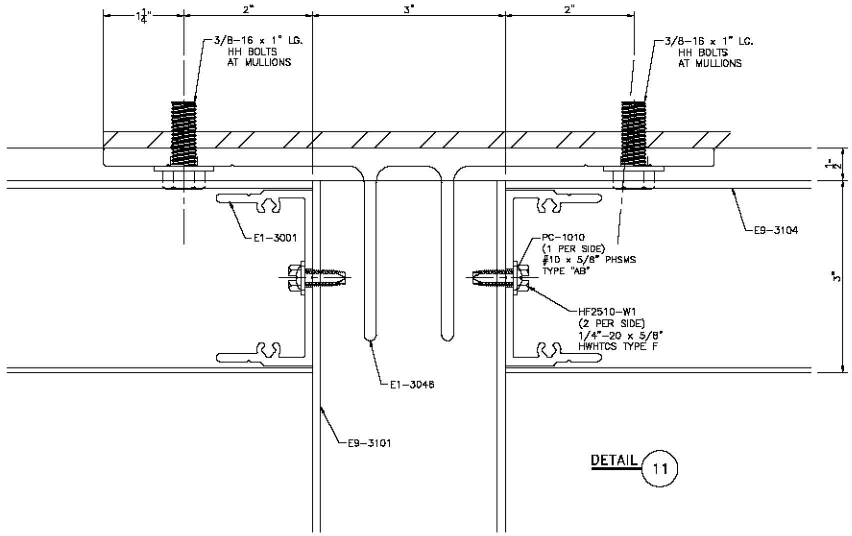

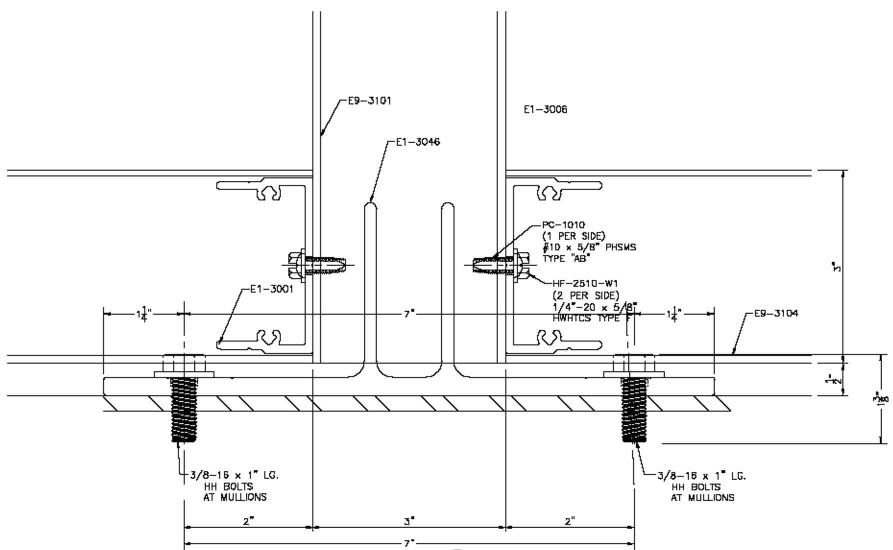

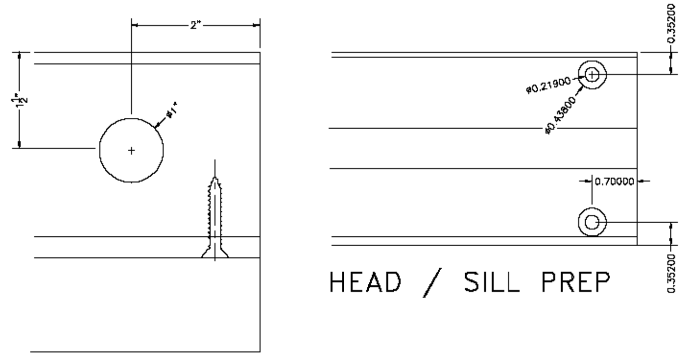

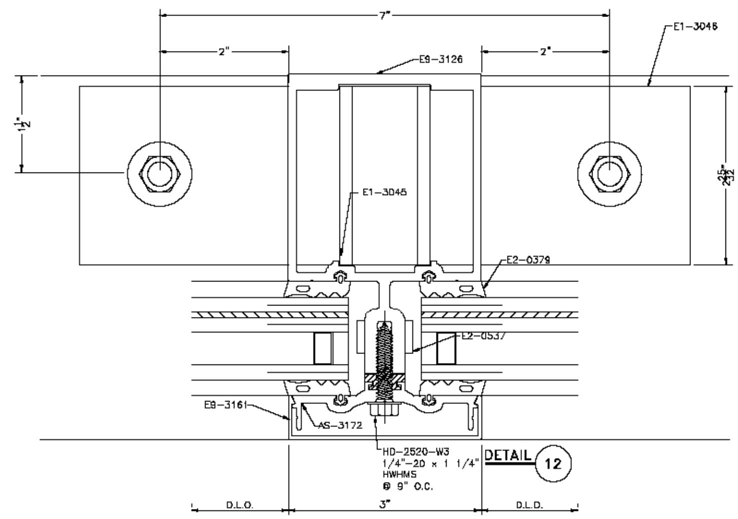

SECTION "B-B"

Intertek
Building Better Together.
Test sample complies with these details.
Deviations are noted.

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(FAX) 678.838.6066

NO.	REVISION	ISSUE DATE	BY	CHD BY

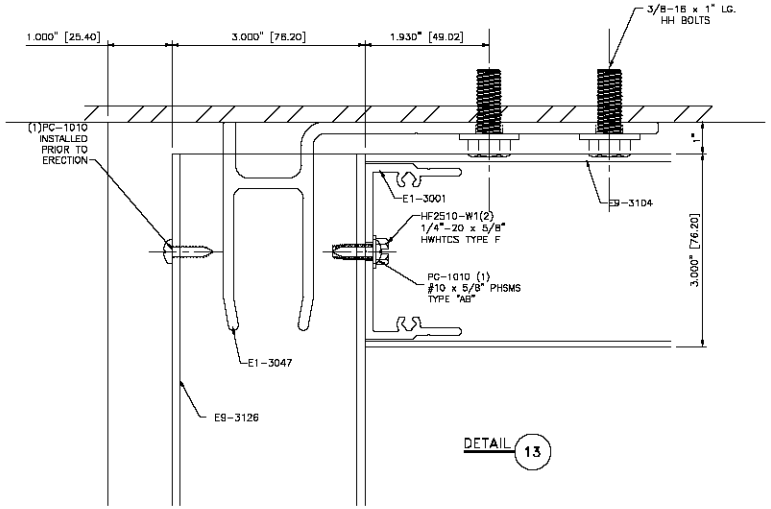
ARCHITECT NAME AND LOCATION:

CUSTOMER NAME AND LOCATION:

PROJECT NAME AND LOCATION:
YHC300 OG
TEST MOCK UP
(SHALLOW MULLION)

DESCRIPTION:

SCALE:	ISSUE DATE:
As Noted	10/02/15
DRAWN BY: dp	SHEET NO.:
CHECKED BY:	3



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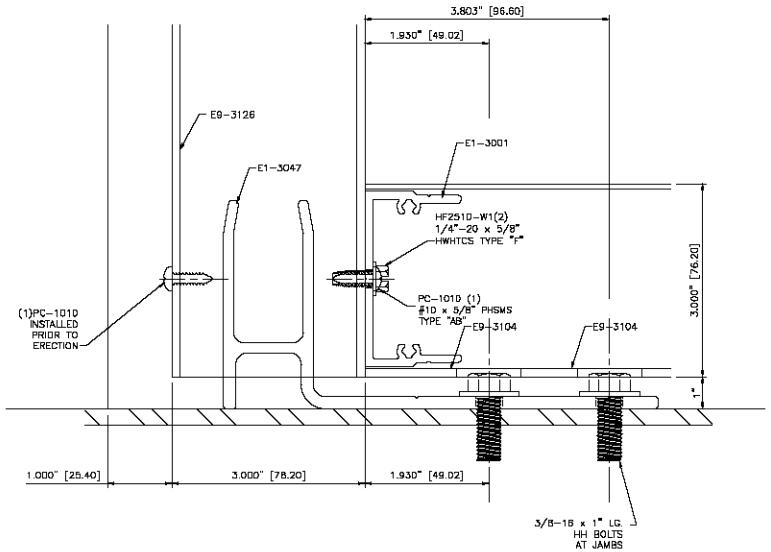

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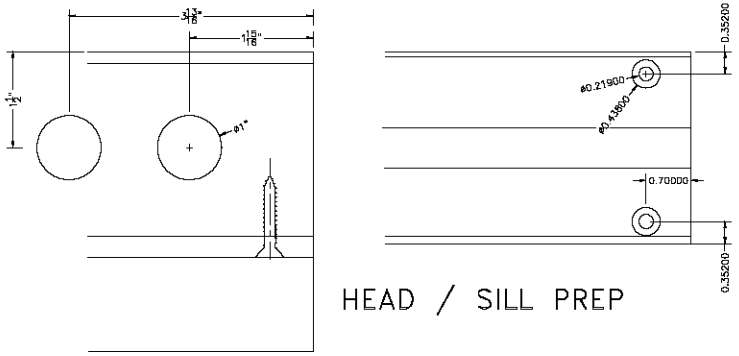
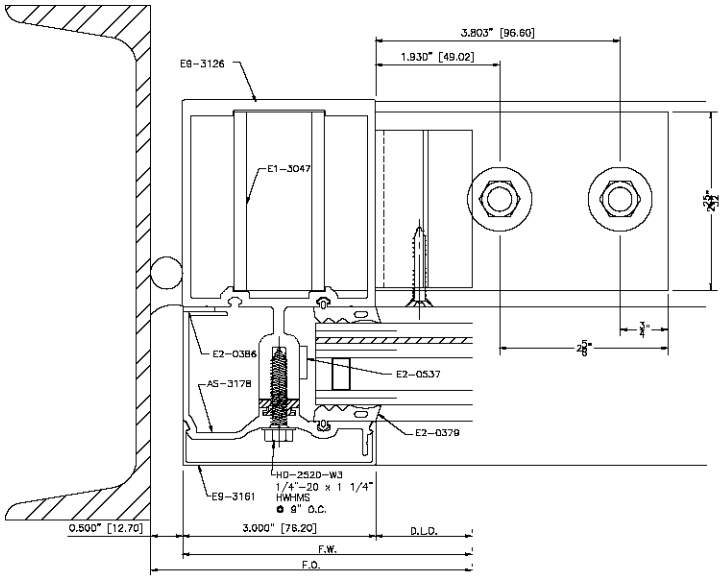


HEAD / SILL PREP



SECTION "B-B"

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(PH) 678.838.8000
(FAX) 678.838.8056

NO.	REVISION	ISSUE DATE	DWN BY

ARCHITECT NAME AND LOCATION:

CUSTOMER NAME AND LOCATION:

PROJECT NAME AND LOCATION:
YHC300 DG
TEST MOCK UP
(SHALLOW MULLION)

DESCRIPTION:

SCALE:	ISSUE DATE:
As Noted	10/02/15
DRAWN BY:	SHEET NO.:
dp	4
CHECKED BY:	

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Architectural Testing

AAMA 507-12 THERMAL PERFORMANCE REPORT

Rendered to:

YKK AP AMERICA

SERIES/MODEL: YHC 300 OG Curtain Wall
TYPE: Glazed Wall System

Report No: **D5331.01-116-45**
Report Date: **03/10/14**

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Architectural Testing

AAMA 507-12 THERMAL PERFORMANCE REPORT

Rendered to:

YKK AP AMERICA
1229 Highway 441 Bypass
Dublin, Georgia 31021

Report No:	D5331.01-116-45
Report Date:	03/10/14
Simulation Date:	03/10/14

Project Summary:

Architectural Testing, Inc. was contracted by YKK AP America to provide U-Factor and Solar Heat Gain Coefficient thermal performance ratings on the YHC 300 OG Curtain Wall Glazed Wall System. The thermal performance ratings were determined in accordance with AAMA 507-12, Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Building.

Reference Documents:

AAMA 507-12, Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Buildings

NFRC 100-2010, *Procedure for Determining Fenestration Product U-Factors*

NFRC 200-2010, *Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence*

Simulation Specimen Description:

Series/Model:	YHC 300 OG Curtain Wall
Type:	Glazed Wall System
Frame Material:	Aluminum Thermally Improved Framing System
Material Finish:	Painted Aluminum
Specimen Size:	2000mm wide by 2000mm high (78-3/4" by 78-3/4")
Configuration:	Two vision lites separated by one intermediate vertical
Drawing Reference:	YKK Drawing YHC 300 O.G., dated 10/09/13

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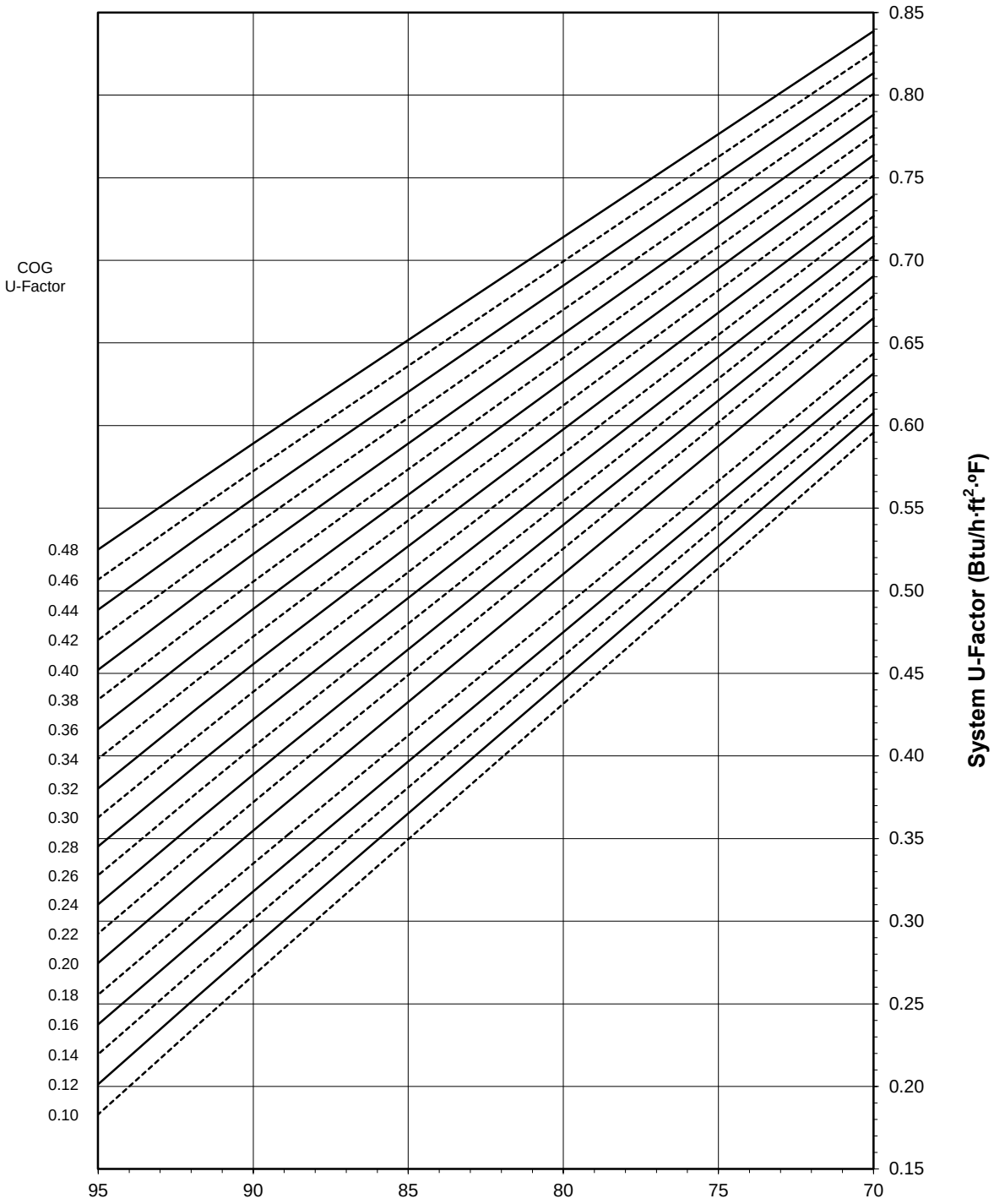
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

YKK AP America
YHC 300 OG Curtain Wall - Glazed Wall System

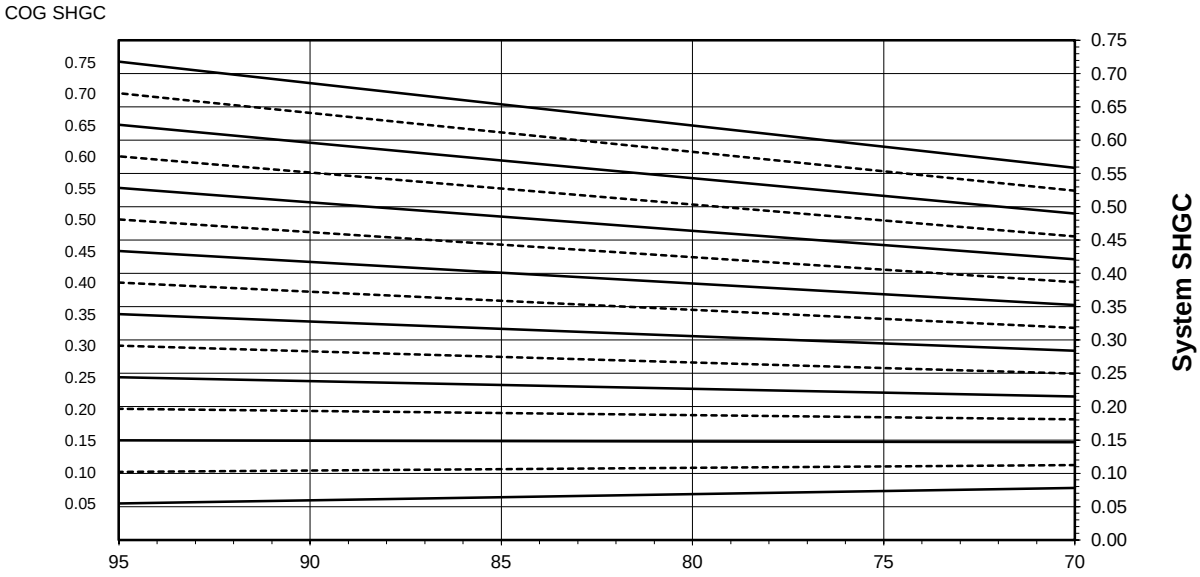
System U-Factor vs. Percentage of Vision Area



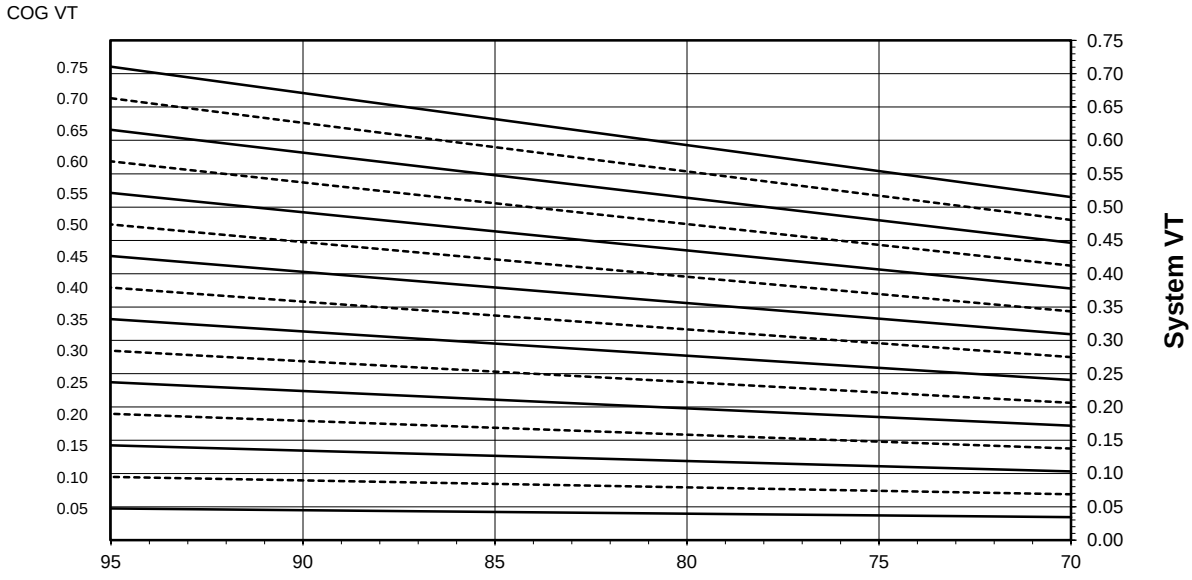
Note: 1-5/16 inch Overall - Dual Glazed Laminated Glass (0.48-0.20 COG) with Aluminum Spacer, Dual Glazed Laminated Glass with Heat Mirror (0.18-0.10 COG) with Aluminum Spacer

YKK AP America
YHC 300 OG Curtain Wall - Glazed Wall System

System SHGC vs. Percentage of Vision Area



System VT vs. Percentage of Vision Area



YKK AP America
YHC 300 OG Curtain Wall - Glazed Wall System

Size Specific U-Factor Matrix*

Glazing Option	Center of Glass U-Factor	Overall U-Factor
1	0.48	0.60
2	0.46	0.59
3	0.44	0.57
4	0.42	0.55
5	0.40	0.54
6	0.38	0.52
7	0.36	0.50
8	0.34	0.49
9	0.32	0.47
10	0.30	0.46
11	0.28	0.44
12	0.26	0.42
13	0.24	0.41
14	0.22	0.39
15	0.20	0.37
16	0.18	0.35
17	0.16	0.34
18	0.14	0.32
19	0.12	0.30
20	0.10	0.29

Note: 1-5/16 inch Overall - Dual Glazed Laminated Glass (0.48-0.20 COG) with Aluminum Spacer, Dual Glazed Laminated Glass with Heat Mirror (0.18-0.10 COG) with Aluminum Spacer

YKK AP America
YHC 300 OG Curtain Wall - Glazed Wall System

Size Specific SHGC Matrix*

Center of Glass SHGC	Overall SHGC
0.75	0.68
0.70	0.63
0.65	0.59
0.60	0.55
0.55	0.50
0.50	0.46
0.45	0.41
0.40	0.37
0.35	0.33
0.30	0.28
0.25	0.24
0.20	0.19
0.15	0.15
0.10	0.10
0.05	0.06

Size Specific VT Matrix*

Center of Glass VT	Overall VT
0.75	0.66
0.70	0.62
0.65	0.57
0.60	0.53
0.55	0.49
0.50	0.44
0.45	0.40
0.40	0.35
0.35	0.31
0.30	0.26
0.25	0.22
0.20	0.18
0.15	0.13
0.10	0.09
0.05	0.04

*Size Specific U-Factor, SHGC, and VT Matrices are based on the standard Glazed Wall System specimen size of 2000mm wide by 2000mm high (78-3/4" by 78-3/4"). This represents 88.9% Vision Area / Total Area.

Vision Area Data

Option No.	COG U-Factor	COG Temperature	Cross Section	Frame Height	Frame U-Factor	Edge U-Factor	Total Product U-Factor		
							70% Vision Area	*NFRC 100-2010*	*95% Vision Area*
							27.84" by 27.84"	*78.74" by 78.74"*	*178.15" by 145.67"*
1	0.48	43.7	Head	1.5732	1.6333	0.4403	0.8387	0.6035	0.5249
			L. Jamb	1.5732	1.6840	0.4390			
			R. Jamb	1.5732	1.6836	0.4392			
			Mullion	3.1463	1.6838	0.4391			
			Sill	1.5732	1.6466	0.4425			
2	0.46	44.8	Head	1.5732	1.6301	0.4257	0.8260	0.5870	0.5067
			L. Jamb	1.5732	1.6807	0.4244			
			R. Jamb	1.5732	1.6804	0.4247			
			Mullion	3.1463	1.6806	0.4245			
			Sill	1.5732	1.6435	0.4279			
3	0.44	45.8	Head	1.5732	1.6270	0.4112	0.8133	0.5705	0.4885
			L. Jamb	1.5732	1.6775	0.4100			
			R. Jamb	1.5732	1.6773	0.4102			
			Mullion	3.1463	1.6774	0.4101			
			Sill	1.5732	1.6404	0.4134			
4	0.42	46.8	Head	1.5732	1.6240	0.3969	0.8007	0.5540	0.4702
			L. Jamb	1.5732	1.6745	0.3957			
			R. Jamb	1.5732	1.6742	0.3959			
			Mullion	3.1463	1.6744	0.3958			
			Sill	1.5732	1.6375	0.3991			
5	0.40	47.9	Head	1.5732	1.6210	0.3824	0.7881	0.5376	0.4521
			L. Jamb	1.5732	1.6715	0.3813			
			R. Jamb	1.5732	1.6713	0.3815			
			Mullion	3.1463	1.6714	0.3814			
			Sill	1.5732	1.6347	0.3847			
6	0.38	48.9	Head	1.5732	1.6182	0.3682	0.7757	0.5212	0.4341
			L. Jamb	1.5732	1.6687	0.3671			
			R. Jamb	1.5732	1.6685	0.3673			
			Mullion	3.1463	1.6686	0.3672			
			Sill	1.5732	1.6319	0.3704			
7	0.36	50.0	Head	1.5732	1.6163	0.3542	0.7637	0.5049	0.4162
			L. Jamb	1.5732	1.6683	0.3523			
			R. Jamb	1.5732	1.6682	0.3524			
			Mullion	3.1463	1.6683	0.3524			
			Sill	1.5732	1.6310	0.3555			
8	0.34	51.0	Head	1.5732	1.6153	0.3390	0.7513	0.4885	0.3983
			L. Jamb	1.5732	1.6655	0.3382			
			R. Jamb	1.5732	1.6654	0.3382			
			Mullion	3.1463	1.6655	0.3382			
			Sill	1.5732	1.6291	0.3414			
9	0.32	52.0	Head	1.5732	1.6126	0.3251	0.7391	0.4720	0.3803
			L. Jamb	1.5732	1.6628	0.3242			
			R. Jamb	1.5732	1.6628	0.3243			
			Mullion	3.1463	1.6628	0.3243			
			Sill	1.5732	1.6266	0.3274			

Vision Area Data

Option No.	COG U-Factor	COG Temperature	Cross Section	Frame Height	Frame U-Factor	Edge U-Factor	Total Product U-Factor		
							70% Vision Area	*NFRC 100-2010*	*95% Vision Area*
							27.84" by 27.84"	*78.74" by 78.74"*	*178.15" by 145.67"*
10	0.30	53.1	Head	1.5732	1.6098	0.3111	0.7267	0.4555	0.3628
			L. Jamb	1.5732	1.6599	0.3103			
			R. Jamb	1.5732	1.6599	0.3104			
			Mullion	3.1463	1.6599	0.3104			
			Sill	1.5732	1.6238	0.3135			
11	0.28	54.2	Head	1.5732	1.6072	0.2973	0.7146	0.4390	0.3452
			L. Jamb	1.5732	1.6574	0.2966			
			R. Jamb	1.5732	1.6574	0.2966			
			Mullion	3.1463	1.6574	0.2966			
			Sill	1.5732	1.6214	0.2997			
12	0.26	55.2	Head	1.5732	1.6051	0.2836	0.7025	0.4226	0.3278
			L. Jamb	1.5732	1.6553	0.2829			
			R. Jamb	1.5732	1.6552	0.2829			
			Mullion	3.1463	1.6553	0.2829			
			Sill	1.5732	1.6193	0.2860			
13	0.24	56.3	Head	1.5732	1.6027	0.2699	0.6905	0.4061	0.3101
			L. Jamb	1.5732	1.6529	0.2692			
			R. Jamb	1.5732	1.6529	0.2693			
			Mullion	3.1463	1.6529	0.2692			
			Sill	1.5732	1.6170	0.2723			
14	0.22	57.3	Head	1.5732	1.6004	0.2563	0.6785	0.3897	0.2924
			L. Jamb	1.5732	1.6507	0.2556			
			R. Jamb	1.5732	1.6506	0.2557			
			Mullion	3.1463	1.6507	0.2557			
			Sill	1.5732	1.6148	0.2587			
15	0.20	58.4	Head	1.5732	1.5983	0.2427	0.6650	0.3727	0.2746
			L. Jamb	1.5732	1.6415	0.2419			
			R. Jamb	1.5732	1.6415	0.2419			
			Mullion	3.1463	1.6415	0.2419			
			Sill	1.5732	1.6126	0.2451			
16	0.18	59.5	Head	1.5732	1.5583	0.2265	0.6437	0.3526	0.2554
			L. Jamb	1.5732	1.6216	0.2232			
			R. Jamb	1.5732	1.6214	0.2232			
			Mullion	3.1463	1.6215	0.2232			
			Sill	1.5732	1.5766	0.2258			
17	0.16	60.6	Head	1.5732	1.5556	0.2129	0.6315	0.3360	0.2375
			L. Jamb	1.5732	1.6188	0.2097			
			R. Jamb	1.5732	1.6186	0.2097			
			Mullion	3.1463	1.6187	0.2097			
			Sill	1.5732	1.5739	0.2122			
18	0.14	61.7	Head	1.5732	1.5532	0.1993	0.6196	0.3194	0.2194
			L. Jamb	1.5732	1.6165	0.1961			
			R. Jamb	1.5732	1.6162	0.1962			
			Mullion	3.1463	1.6163	0.1962			
			Sill	1.5732	1.5715	0.1987			

Vision Area Data

Option No.	COG U-Factor	COG Temperature	Cross Section	Frame Height	Frame U-Factor	Edge U-Factor	Total Product U-Factor		
							70% Vision Area	*NFRC 100-2010*	*95% Vision Area*
							27.84" by 27.84"	*78.74" by 78.74"*	*178.15" by 145.67"*
19	0.12	62.8	Head	1.5732	1.5510	0.1857	0.6076	0.3027	0.2012
			L. Jamb	1.5732	1.6144	0.1825			
			R. Jamb	1.5732	1.6141	0.1826			
			Mullion	3.1463	1.6142	0.1826			
			Sill	1.5732	1.5693	0.1851			
20	0.10	63.9	Head	1.5732	1.5490	0.1721	0.5958	0.2860	0.1830
			L. Jamb	1.5732	1.6124	0.1688			
			R. Jamb	1.5732	1.6122	0.1690			
			Mullion	3.1463	1.6123	0.1689			
			Sill	1.5732	1.5673	0.1715			

Architectural Testing will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Architectural Testing, Inc. for the entire test record retention period. The test record retention end date for this report is March 10, 2018.

Results obtained are simulated values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the product simulated. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

SIMULATED BY:

Allison M. Goodyear
Simulation Technician

REVIEWED BY:

Kevin S. Louder
Project Engineer

AMG:AMG
D5331.01-116-45

Attachments (pages): This report is complete only when all attachments listed are included.

Appendix A: Drawings and Bills of Material (10)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
.01R0	03/10/14	All	Original Report Issued to YKK AP America

All drawings and Bills of Material used in simulating this product are enclosed in this Appendix.

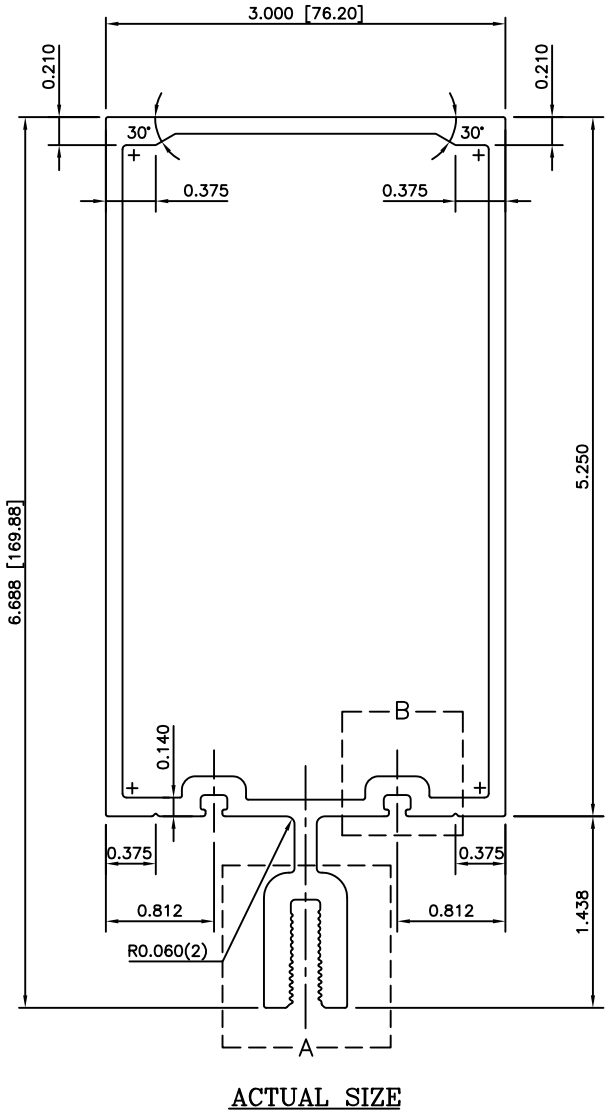
Appendix A

D5331.01-116-45

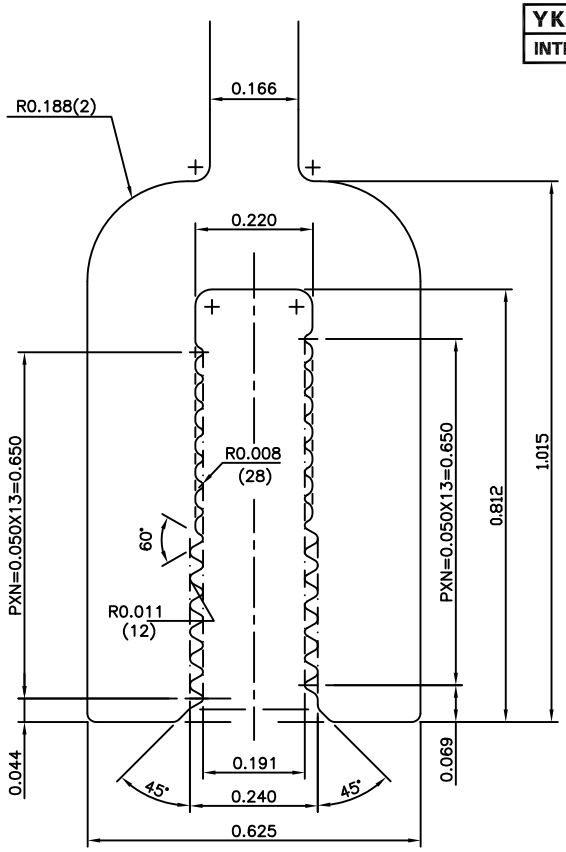
Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

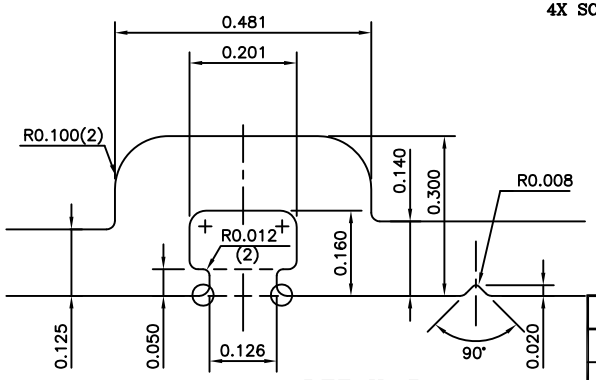
YKK AP GROUP
INTERNAL USE ONLY



ACTUAL SIZE



DETAIL A
4X SCALE

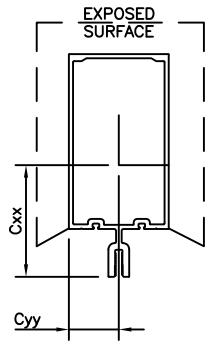


DETAIL B
4X SCALE

Material: Painted or Anodized Aluminum

E.C.	REV.	DRAWN BY	DESCRIPTION	DATE
		A.OI	ADD. DIMENSION 0.069	05/19/97
	A	D.O.	CHANGED TEMPER TO T6	06/16/05
	B	C.T.	REVISED PROPERTIES/REDRAWN	02/01/11

DRAWING NUMBER E9-3101 B



GENERAL NOTES

1) 0.125"[3.18mm] TYP. WALL THICKNESS UNLESS OTHERWISE SPECIFIED.
2) MATES WITH
3) 0.016" TYP. RAD. UNLESS OTHERWISE SPECIFIED.
4) CROSS (+) INDICATES 0.031" RAD.
5) CIRCLE (O) INDICATES 0.020" RAD.
6) SYMBOL (⌐) INDICATES MINIMUM RAD. OF 0.008".

MOMENT OF INERTIA (in⁴)	Ixx	13.312 [554.07cm⁴]
	Iyy	3.317 [138.05cm⁴]
SECTION MODULUS (in³)	Sxx	3.972 [65.09cm³]
	Syy	2.211 [36.23cm³]
CENTER OF GRAVITY (in)	Cxx	3.351 [8.51cm]
	Cyy	1.500 [3.81cm]
AREA (in²)		2.689 [17.35cm²]
WT./FT.		3.162 [4.705kg/m]
CIR. SIZE (in)		7.031 [17.86cm]
OS. PMTR. (in)		22.882 [58.12cm]
T. PMTR. (in)		38.645 [98.16cm]
PTD. PMTR. (in)		15.454 [39.25cm]

STANDARD A.A. TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

ALLOY AND TEMPER: 6063-T6

FINISH: PAINTED OR ANODIZED

DESCRIPTION: MULLION FOR 1" GLAZING

SYSTEM: YHC-300

SCALE: AS NOTED

DRAWING NUMBER E9-3101 B

YKK ap

DRAWN BY R.B.E.

DATE 8/22/96

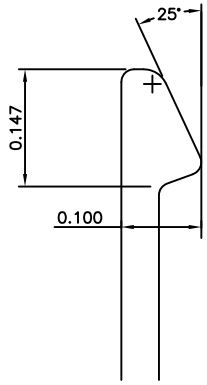
APPROVED BY J.A.

Architectural Testing

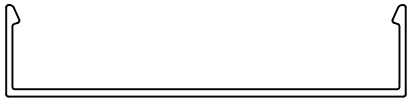
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

YKK AP GROUP
INTERNAL USE ONLY

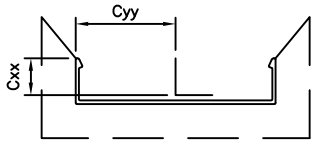
DRAWING NUMBER E9-3161 B

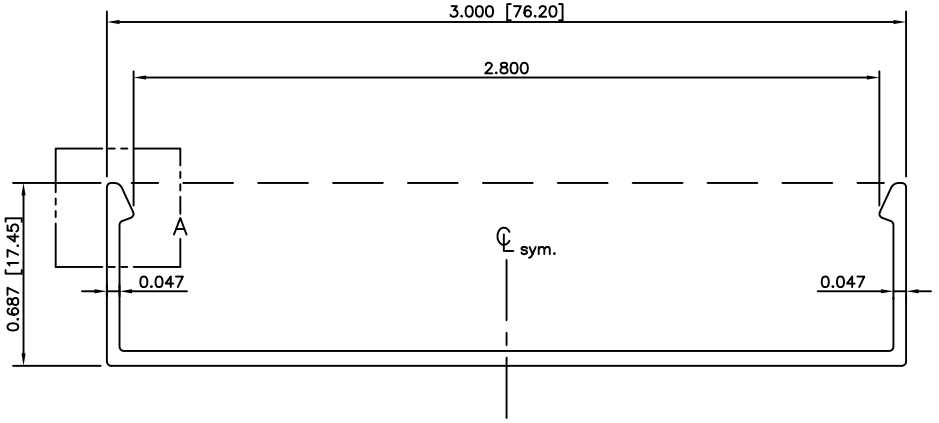


DETAIL A
6X SCALE



ACTUAL SIZE





2X SCALE

GENERAL NOTES

1) 0.056"[1.42mm] TYP. WALL THICKNESS UNLESS OTHERWISE SPECIFIED.
2) MATES WITH E9-3131, E9-3132.
3) 0.016" TYP. RAD. UNLESS OTHERWISE SPECIFIED.
4) CROSS (+) INDICATES 0.031" RAD.
5) CIRCLE (O) INDICATES 0.020" RAD.
6) SYMBOL (⌐) INDICATES MINIMUM RAD. OF 0.008".

MOMENT OF INERTIA (in⁴)	Ixx	0.009 [0.38cm⁴]
	Iyy	0.272 [11.34cm⁴]
SECTION MODULUS (in³)	Sxx	0.016 [0.27cm³]
	Syy	0.182 [2.98cm³]
CENTER OF GRAVITY (in)	Cxx	0.552 [1.40cm]
	Cyy	1.500 [3.81cm]
AREA (in²)		0.236 [1.52cm²]
WT./FT.		0.277 [0.412kg/m]
CIR. SIZE (in)		3.071[7.80cm]
OS. PMTR. (in)		8.673 [22.03cm]
T. PMTR. (in)		8.673 [22.03cm]
PTD. PMTR. (in)		5.353 [13.60cm]

STANDARD A.A. TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

ALLOY AND TEMPER: 6063-T5

FINISH: PAINTED OR ANODIZED

DESCRIPTION: SNAP COVER

SYSTEM: YHC 300

SCALE: AS NOTED

E.C.	REV.	DRAWN BY	DESCRIPTION	DATE
	A	R.B.E.	REDESIGNED & REDRAWN	10/24/96
		A.OI	REV. DIM. FROM 0.153 TO 0.147	06/03/97
	B	C.T.	REVISED PROPERTIES/REDRAWN	02/02/11

Material: Painted or Anodized Aluminum

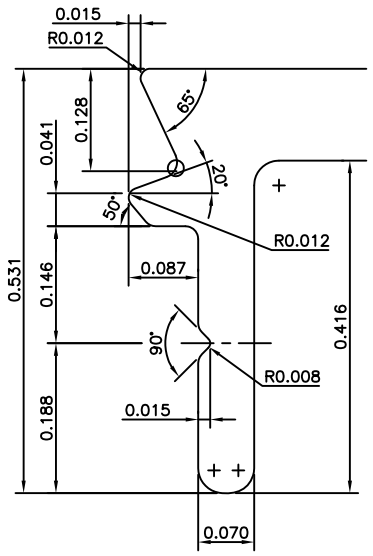
DRAWING NUMBER E9-3161 B

YKK ap

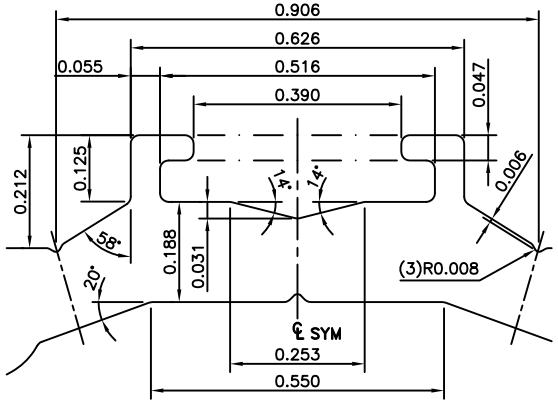
DRAWN BY R.B.E.
DATE 08/24/96
APPROVED BY J.I.A.

Architectural Testing

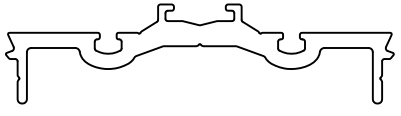
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear



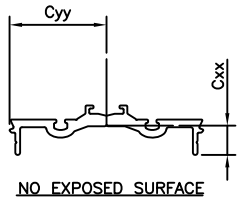
DETAIL A
6X SCALE



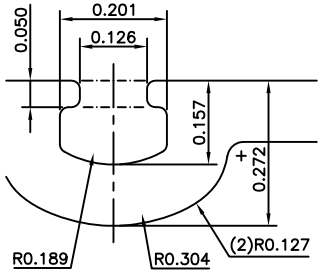
DETAIL C
4X SCALE



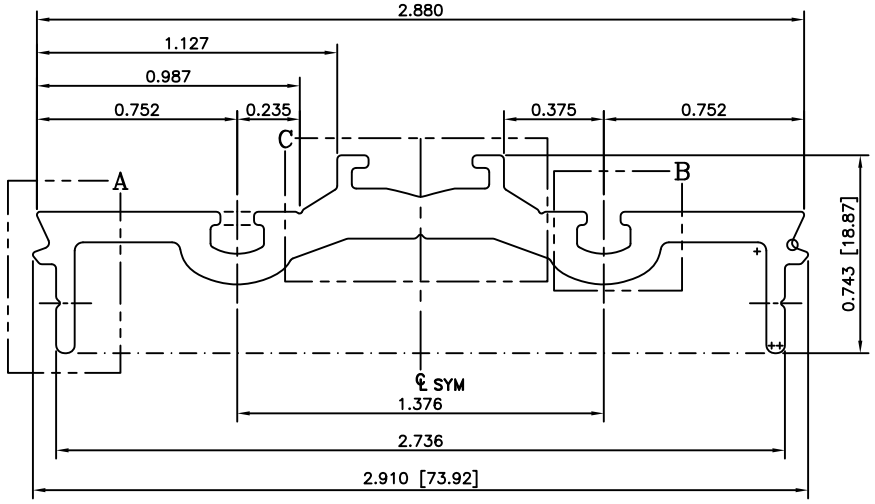
ACTUAL SIZE



NO EXPOSED SURFACE



DETAIL B
4X SCALE



2X SCALE

GENERAL NOTES

1) 0.115"[2.92mm] TYP. WALL THICKNESS UNLESS OTHERWISE SPECIFIED.
2) MATES WITH E9–3161.
3) 0.016" TYP. RAD. UNLESS OTHERWISE SPECIFIED.
4) CROSS (+) INDICATES 0.031" RAD.
5) CIRCLE (O) INDICATES 0.020" RAD.
6) SYMBOL (⌐) INDICATES MINIMUM RAD. OF 0.008".

MOMENT OF INERTIA (in⁴)	Ixx	0.008 [0.33cm⁴]
	Iyy	0.376 [15.65cm⁴]
SECTION MODULUS (in³)	Sxx	0.018 [0.30cm³]
	Syy	0.258 [4.23cm³]
CENTER OF GRAVITY (in)	Cxx	0.439 [1.12cm]
	Cyy	1.455 [3.70cm]
AREA (in²)		0.535 [3.45cm²]
WT./FT.		0.629 [0.935kg/m]
CIR. SIZE (in)		2.910 [7.39cm]
OS. PMTR. (in)		9.400 [23.87cm]
T. PMTR. (in)		9.400 [23.87cm]
PTD. PMTR. (in)		[cm]

STANDARD A.A. TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

ALLOY AND TEMPER: 6063–T5

FINISH: MILL

DESCRIPTION: PRESSURE PLATE FOR 1 5/16" GLASS

SYSTEM: YHC 300 OG

SCALE: AS NOTED

E.C.	REV.	DRAWN BY	DESCRIPTION	DATE

Material: Painted or Anodized Aluminum

DRAWING NUMBER E9–3172

YKK AP

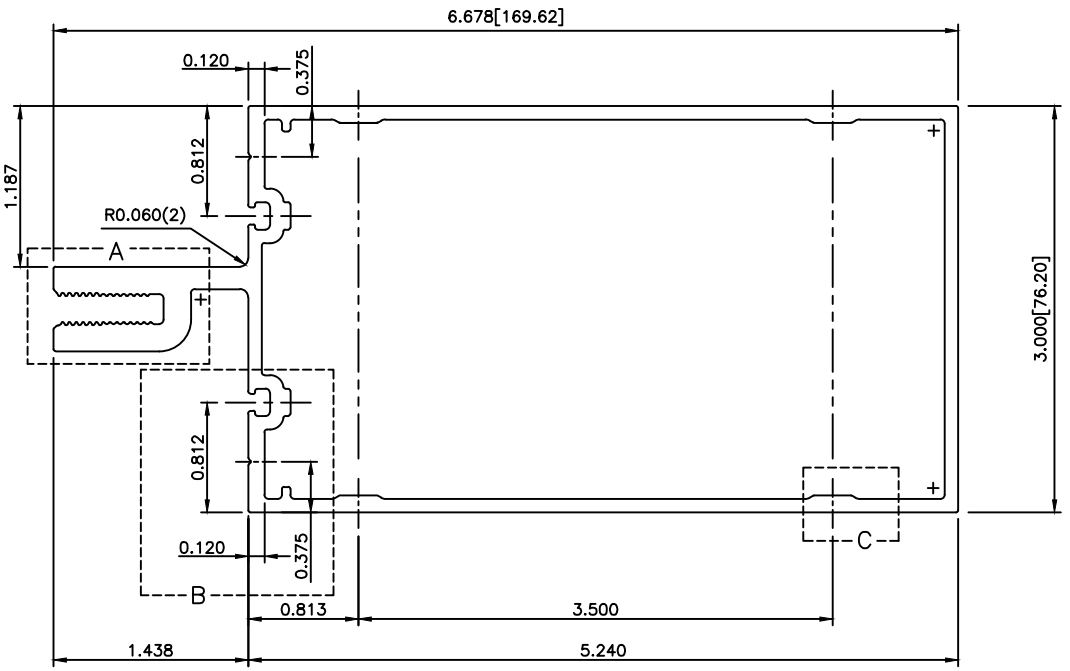
DRAWN BY D.O.
DATE 11/12/08
APPROVED BY D.P.

DRAWING NUMBER E9–3172

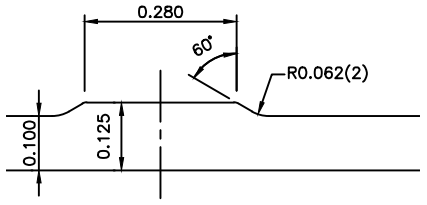
Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Hoodjer

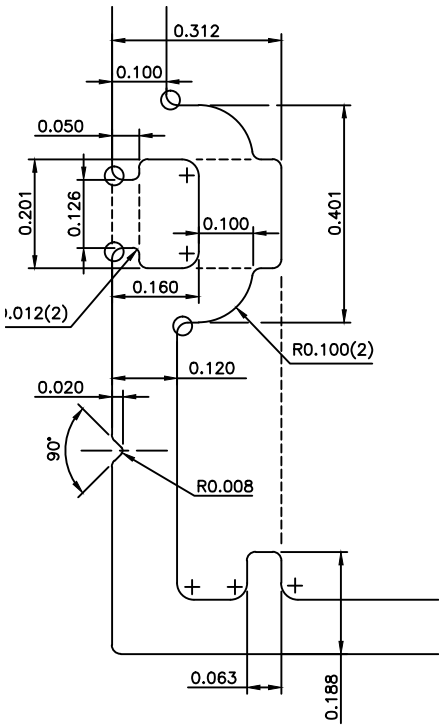
YKK AP GROUP
INTERNAL USE ONLY



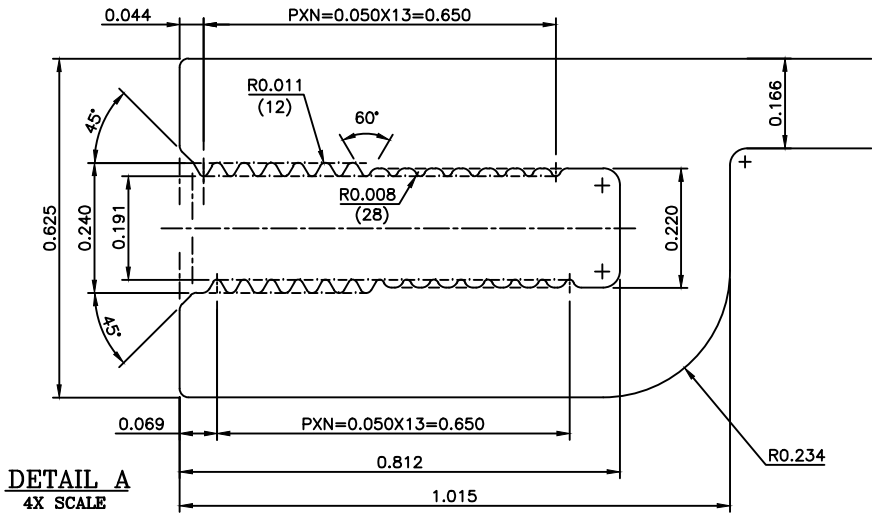
ACTUAL SIZE



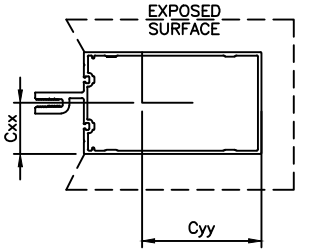
DETAIL C
4X SCALE



DETAIL B
4X SCALE



DETAIL A
4X SCALE



DRAWING NUMBER E9-3102 B

GENERAL NOTES

1) 0.100"[2.54 mm] TYP. WALL THICKNESS UNLESS OTHERWISE SPECIFIED.
2) MATES WITH
3) 0.016" TYP. RAD. UNLESS OTHERWISE SPECIFIED.
4) CROSS (+) INDICATES 0.031" RAD.
5) CIRCLE (O) INDICATES 0.020" RAD.
6) SYMBOL (⌐) INDICATES MINIMUM RAD. OF 0.008".

MOMENT OF INERTIA (in⁴)	Ixx	2.746 [114.29cm⁴]
	Iyy	11.166 [464.75cm⁴]
SECTION MODULUS (in³)	Sxx	1.820 [29.82cm³]
	Syy	3.168 [51.92cm³]
CENTER OF GRAVITY (in)	Cxx	1.509 [3.83cm]
	Cyy	3.524 [8.95cm]
AREA (in²)		2.277 [14.69cm²]
WT./FT.		2.678 [3.985kg/m]
CIR. SIZE (in)		7.021[17.83cm]
OS. PMTR. (in)		22.937 [58.26cm]
T. PMTR. (in)		39.393 [100.06cm]
PTD. PMTR. (in)		15.434 [39.20cm]

STANDARD A.A. TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

ALLOY AND TEMPER: 6063-T5

FINISH: PAINTED OR ANODIZED

DESCRIPTION: HORIZONTAL FOR 1" GLAZING

SYSTEM: YHC-300

SCALE: AS NOTED

E.C.	REV.	DRAWN BY	DESCRIPTION	DATE
	A	R.B.E.	REV. DIM. FROM 0.300 TO 0.312, 0.125 TO 0.120 & ADDED NUBS.	04/29/97
	B	C.T.	REVISED PROPERTIES/REDRAWN	02/01/11

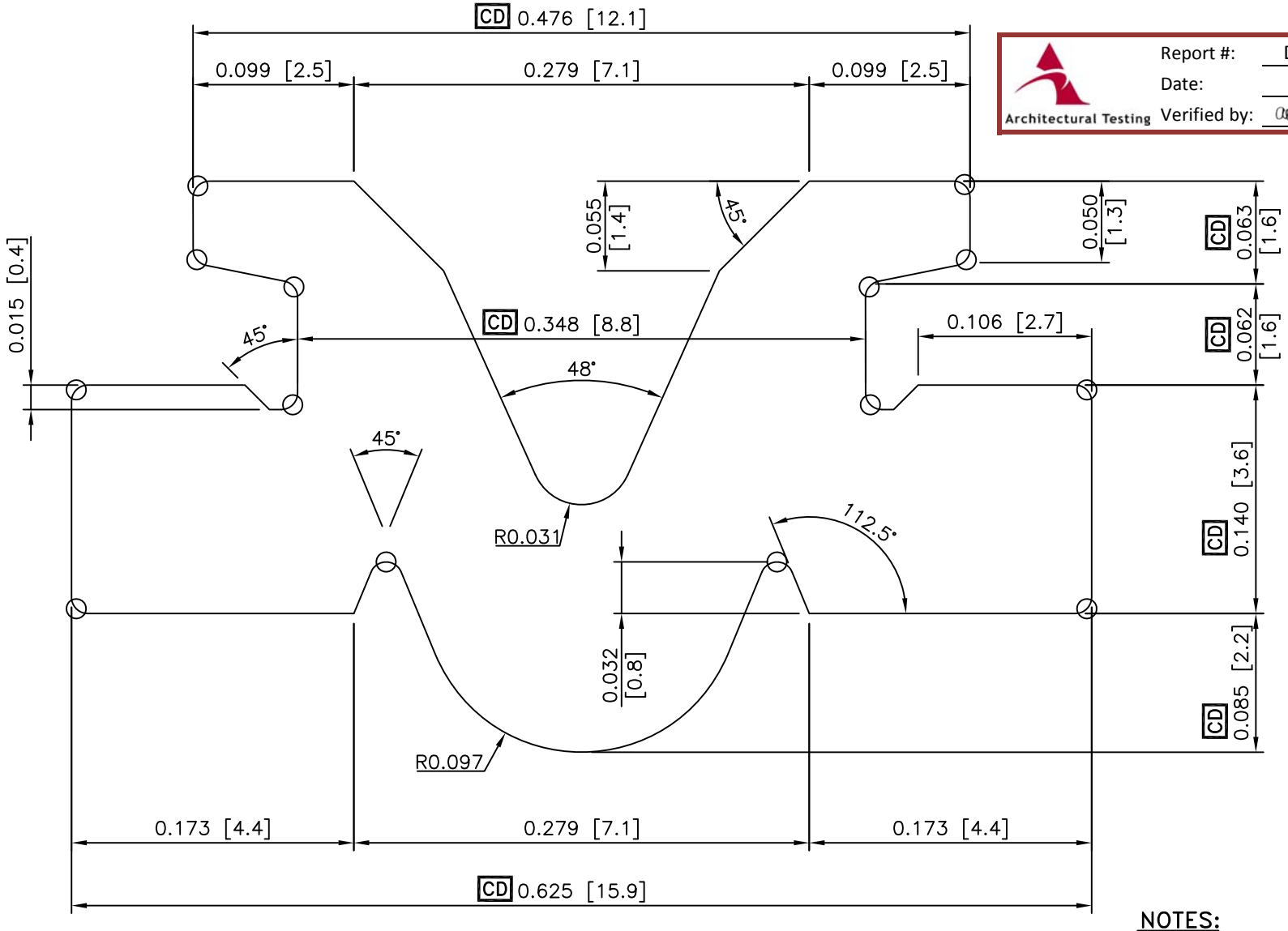
DRAWING NUMBER E9-3102 B

YKK ap

DRAWN BY R.B.E.
DATE 08/22/96
APPROVED BY J.A.

Material: Painted or Anodized Aluminum

E2-0103 | F



10X SCALE

Architectural Testing
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

ACTUAL SIZE

NOTES:
CD MARK INDICATES RMA CLASS 1.
CIRCLE (O) INDICATES 0.010" [0.3] RAD.

REV.	DESCRIPTION	BY	DATE
C	REVISED DIMS. & TOL. (REDRAWN)	A.OI	3/26/99
D	REVISED DESIGN (REDRAWN)	A.OI	1/8/04
E	REVISED DESIGN (REDRAWN)	dp	6/6/06
F	MATERIAL WAS PVC	dp	2/11/09

MATERIAL: F EPDM DUROMETER: 90±5
TOLERANCE: RMA CLASS 2
SYSTEM: YCW 750 OG, 750 OSS
FINISH: COLOR: BLACK
DESCRIPTION: THERMAL ISOLATOR

SCALE	DRAWN BY	DATE	APPROVED BY
10/1, 1/1	SMD	12/22/93	LFG

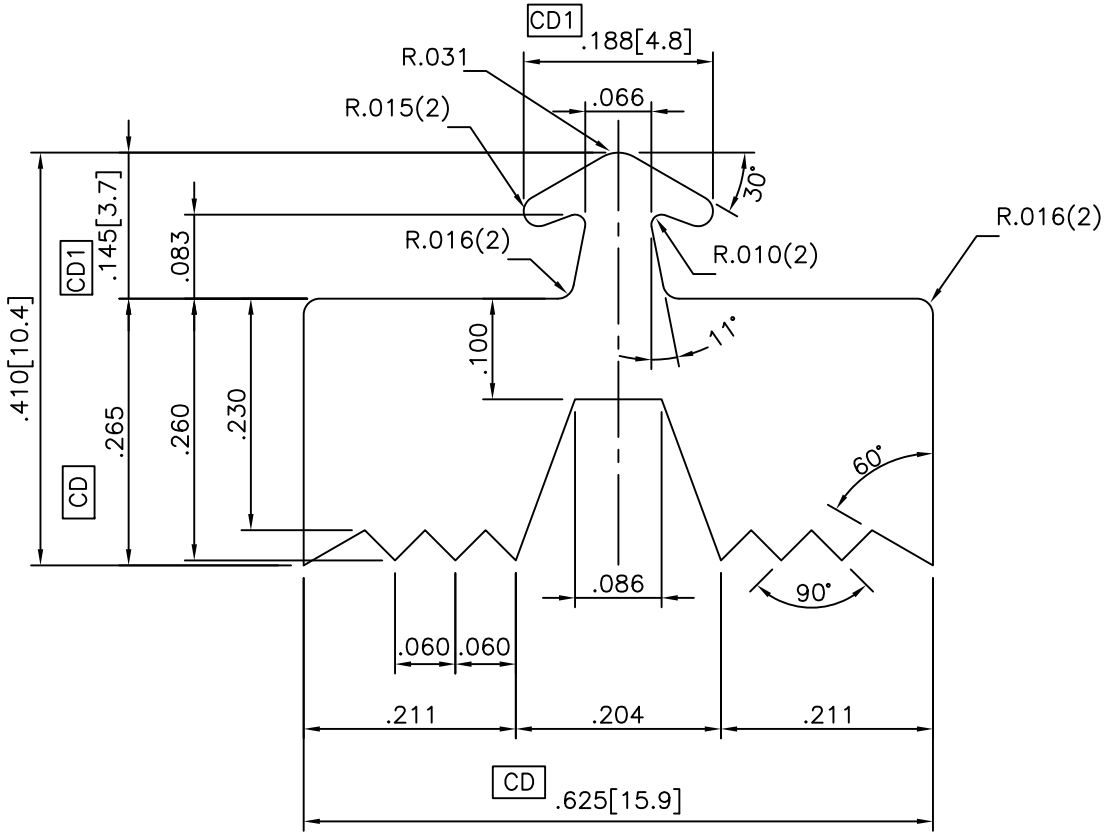
YKK AP

DRAWING NUMBER: E2-0103
REV.: F

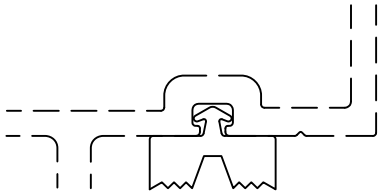
E2-0353

Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear



5X SCALE



ACTUAL SIZE

NOTE:
1) CD1 INDICATES RMA CLASS-1
2) VENDOR: TREMCO
3) COMPOUND: SCR-900

CD : CRITICAL DIMENSION

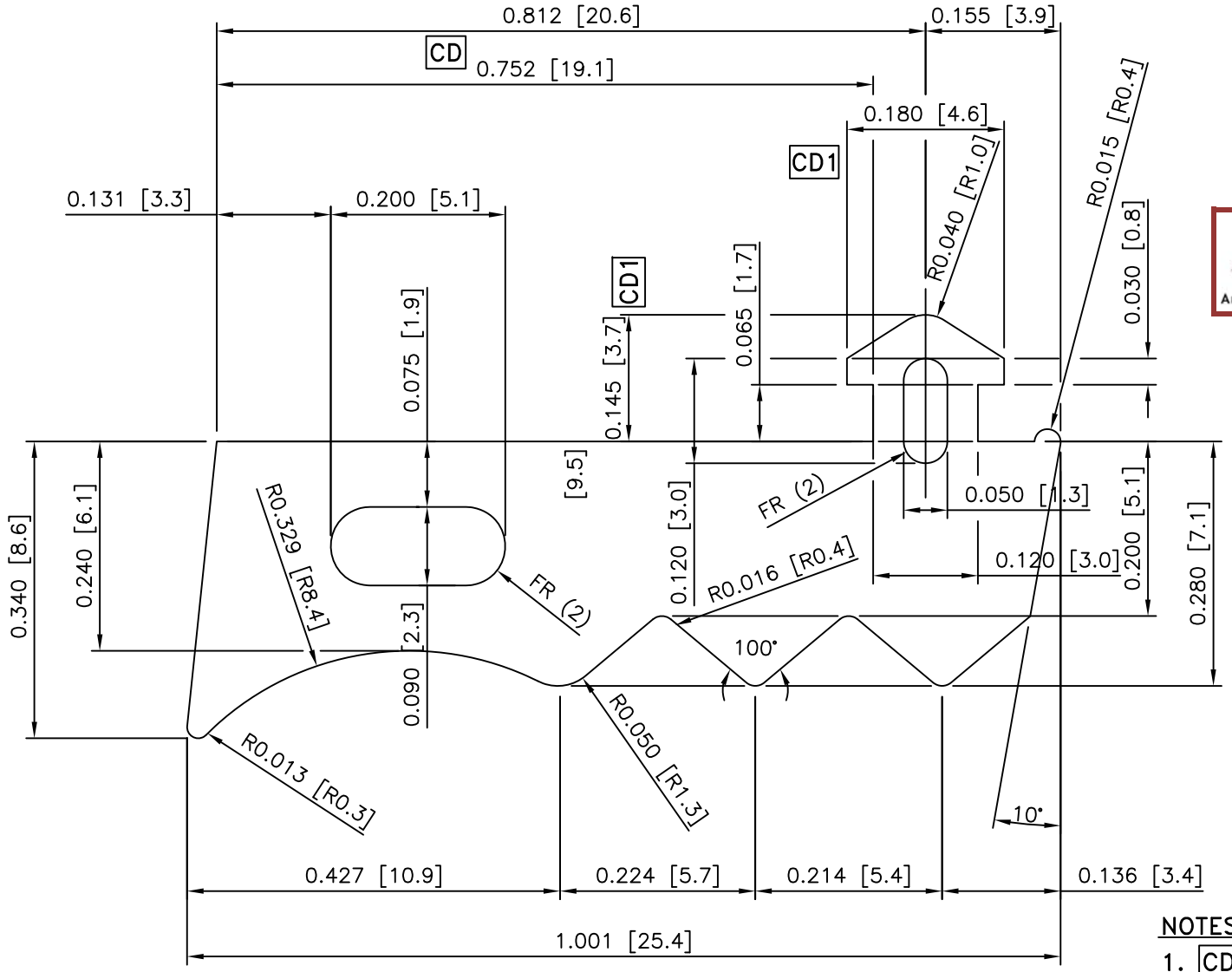
REV.	DESCRIPTION	BY	DATE

MATERIAL: EPDM (SILICONE COMPATIBLE) DUROMETER: 70±5		TOLERANCE: RMA CLASS-2	
SYSTEM: YHC 300		FINISH: COLOR: BLACK	
DESCRIPTION: GLAZING SPACER (1/4" F.C.)			
SCALE: 5/1,1/1	DRAWN BY: R.B.E.	DATE: 06/16/97	APPROVED BY: A.OI

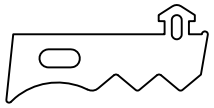
YKK ap America

DRAWING NUMBER: E2-0353
REV.

E2-0379



5X SCALE



ACTUAL SIZE

Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

NOTES:
1. CD CRITICAL DIMENSION.
2. CD1 MARK INDICATES RMA CLASS 1.
✳3. PEROXIDE CURED EPDM.

REV.	DESCRIPTION	BY	DATE

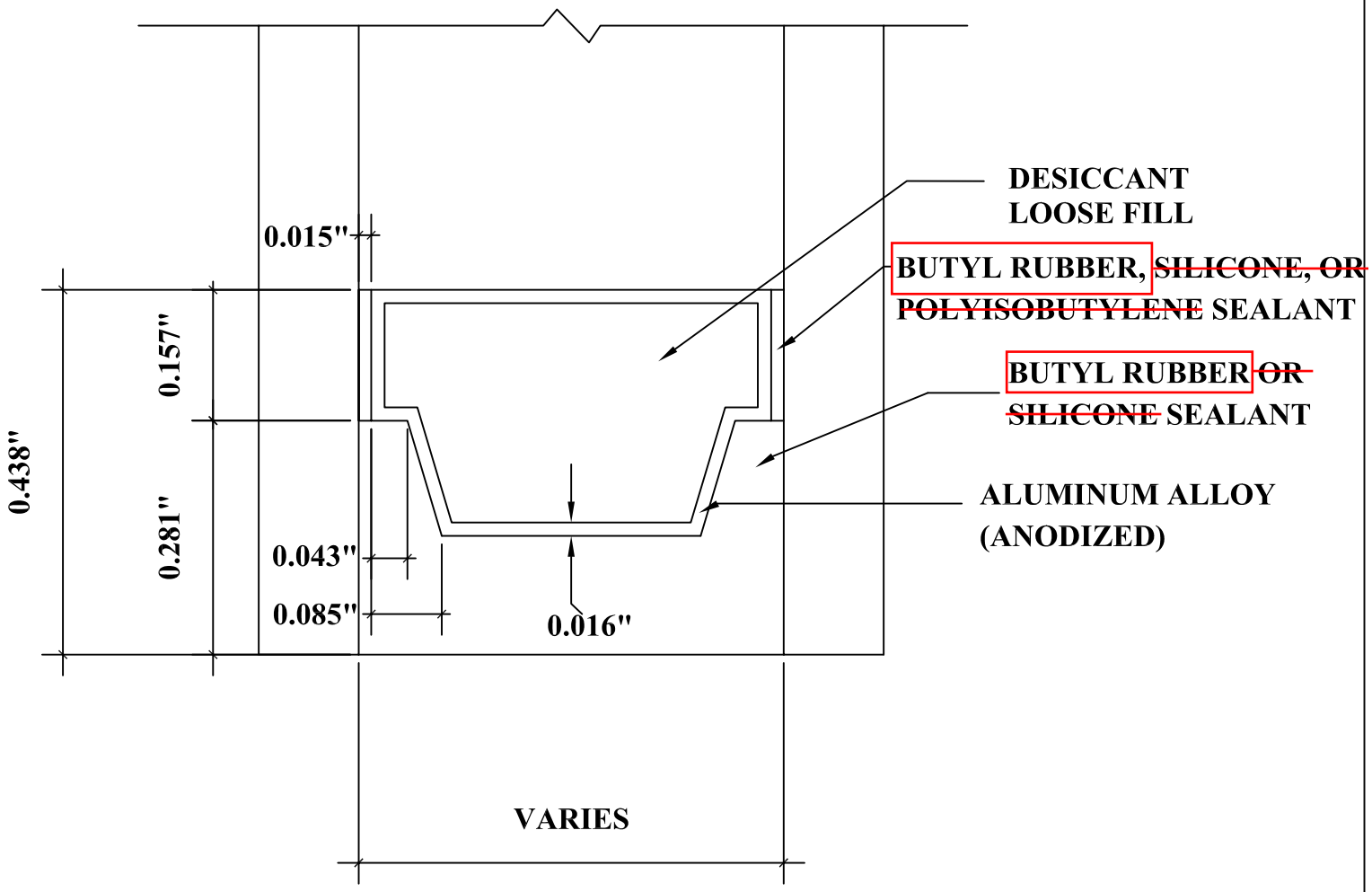
MATERIAL ✳EPDM (DUROMETER: 60±5) SILICONE COMPATIBLE		TOLERANCE RMA CLASS 2	
SYSTEM YHC 300 OG		FINISH COLOR: BLACK	
DESCRIPTION EXTERIOR/INTERIOR GASKET 0.250 F.C.			
SCALE 5/1, 1/1	DRAWN BY dp	DATE 11/20/08	APPROVED BY DP

YKK AP

DRAWING NUMBER E2-0379 | REV.

Architectural Testing

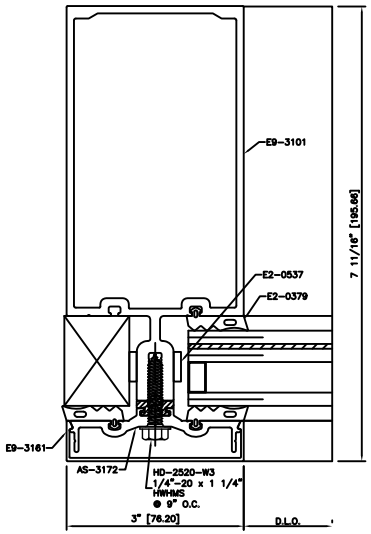
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

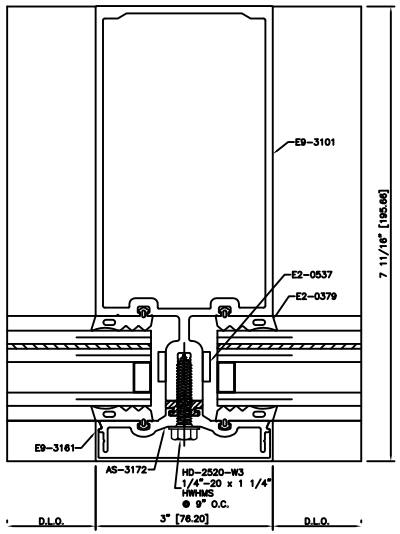


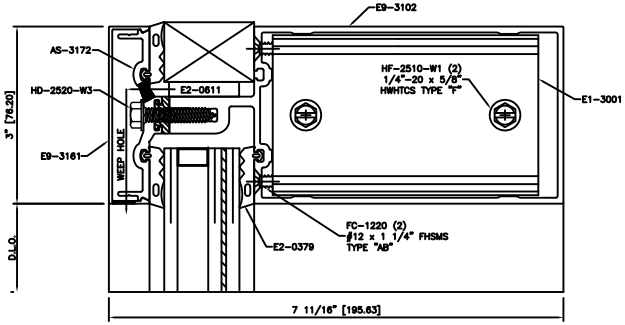
DETAIL FOR THERMAL MODELING OF
ALUMINUM SPACER (A1-D)

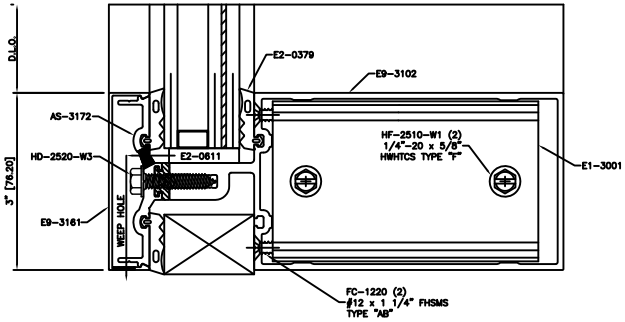
Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear









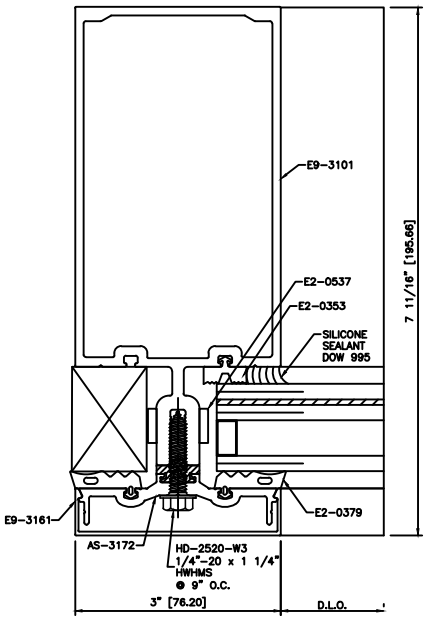
YHC 300 OG Curtain Wall - Dry Glazed

Architectural Testing

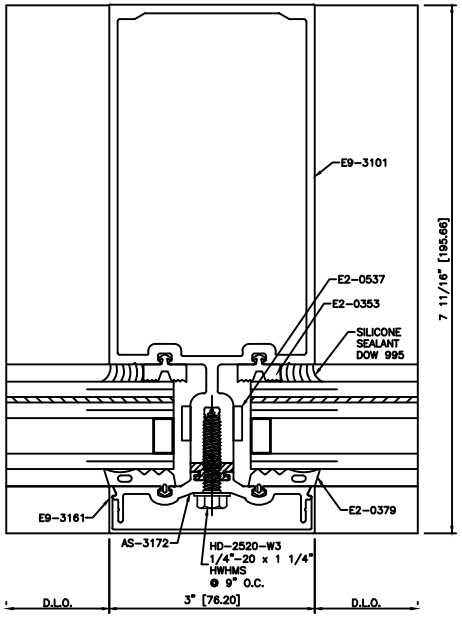
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

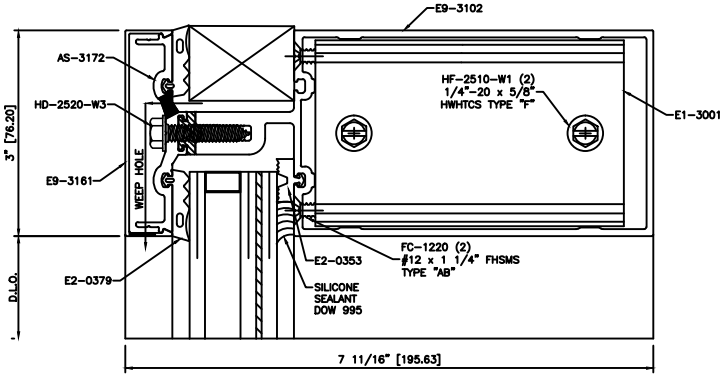
REV.	DESCRIPTION	BY	DATE

SECTION 1
HALF SCALE

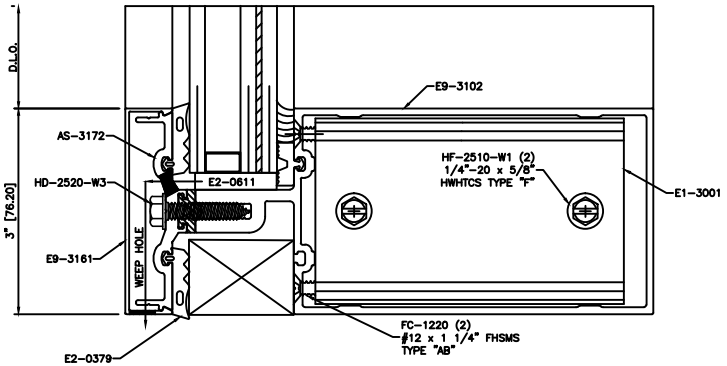


SECTION 2
HALF SCALE

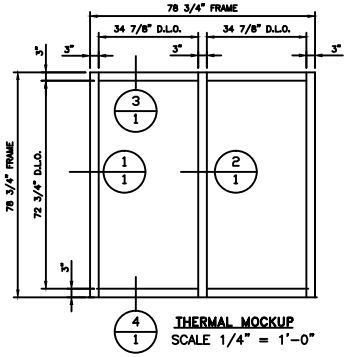




SECTION 3
HALF SCALE



SECTION 4
HALF SCALE



THERMAL MOCKUP
SCALE 1/4" = 1'-0"

YHC 300 OG Curtain Wall - Wet Glazed

YKK AP AMERICA INC.
332 FIRETOWER ROAD
DUBLIN, GEORGIA 31021

SYSTEM: YHC 300 O.G.	SCALE: AS NOTED
	GLAZING:
DESCRIPTION: THERMAL MOCK-UP TEST	
FINISH: painted	
DRAWING NUMBER: YHC 300 IG	
APPROVED BY:	DRAWN BY: PST / DATE: 10/09/13 / SHEET NO.: 1

Architectural Testing

AAMA 1503-09 THERMAL PERFORMANCE TEST REPORT

Rendered to:

YKK AP AMERICA

SERIES/MODEL: YHC 300 OG Curtain Wall
TYPE: Glazed Wall Systems (Site-built)

Summary of Results	
Thermal Transmittance (U-Factor)	0.43
Condensation Resistance Factor - Frame (CRF_f)	72
Condensation Resistance Factor - Glass (CRF_g)	68

Unit Size	78-3/4" x 78-3/4" (2000 mm x 2000 mm)
Layer 1	1/4" AFG Comfort Ti-AC 40 (e=0.043*, #2) Tempered
Gap 1	0.50" Gap, Stainless Steel Spacer (SS-D), Air-Filled*
Layer 2	0.563 Clear Laminated (0.060 PVB)

Reference must be made to Report No. 93842.02-116-46, dated 10/20/09 for complete test specimen description and data.

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Architectural Testing

AAMA 1503-09 THERMAL PERFORMANCE TEST REPORT

Rendered to:

YKK AP AMERICA
7680 The Bluffs, Suite 100
Austell, Georgia 30168

Report Number:	93842.02-116-46
Test Date:	08/15/09
Report Date:	10/20/09
Expiration Date:	08/15/13

Test Sample Identification:

Series/Model: YHC 300 OG Curtain Wall

Type: Glazed Wall Systems (Site-built)

Test Sample Submitted by: Client

Test Procedure: The condensation resistance factor (CRF) and thermal transmittance (U) were determined in accordance with AAMA 1503-09, *Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections*

1. Average warm side ambient temperature 69.80 F
2. Average cold side ambient temperature -0.39 F
3. 15 mph dynamic wind applied to test specimen exterior.
4. 0.0" $\pm$0.04" static pressure drop across specimen.

Test Results Summary:

1. Condensation resistance factor - Frame (CRF_f) 72
   Condensation resistance factor - Glass (CRF_g) 68
2. Thermal transmittance due to conduction (U_c) 0.43
   (U-factors expressed in Btu/hr·ft^2·F)

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Test Sample Description:

CONSTRUCTION		**Frame**
	Size (in.) Non-Standard	78-3/4" x 78-3/4"
	Daylight Opening (in.)	34-7/8" x 72-3/4" (x2)
CORNERS		Butt
	Fasteners	Screws
	Sealant	Yes
MATERIAL		AU (0.13")
	Color Exterior	Brown
	Finish Exterior	Anodized
	Color Interior	White/Brown
	Finish Interior	Anodized
GLAZING METHOD		Pressure

Glazing Information:

Layer 1	1/4" AFG Comfort Ti-AC 40 (e=0.043*, #2) Tempered
Gap 1	0.50" Gap, Stainless Steel Spacer (SS-D), Air-Filled*
Layer 2	0.563 Clear Laminated (0.060 PVB)
Gas Fill Method	N/A*
Desiccant	Yes

**Stated per Client/Manufacturer*
NA Non-Applicable
See Description Table Abbreviations

Test Sample Description: (Continued)

COMPONENTS		
Type	**Quantity**	**Location**
WEATHERSTRIP		
EPDM Pressure gasket	1 Row	Interior glazing perimeter, exterior glazing perimeter, and between
HARDWARE		
Aluminum pressure plates	7	4 Horizontal, 3 vertical at exterior glazing edges
Aluminum snap cover	7	4 Horizontal, 3 vertical at pressure plates
DRAINAGE		
No visible weeps		

Test Duration:

1. The environmental systems were started at 12:27 hours, 08/14/09.

2. The thermal performance test results were derived from 03:59 hours, 08/15/09 to 07:59 hours, 08/15/09.

Condensation Resistance Factor (CRF):

The following information, condensed from the test data, was used to determine the condensation resistance factor:

T_h	=	Warm side ambient air temperature	69.80 F
T_c	=	Cold side ambient air temperature	-0.39 F
FT_p	=	Average of pre-specified frame temperatures (14)	50.73 F
FT_r	=	Average of roving thermocouples (4)	44.83 F
W	=	$(FT_p - FT_r) / [FT_p - (T_c + 10)] \times 0.40$	0.057
FT	=	$FT_p(1-W) + W (FT_r)$ = Frame Temperature	50.39 F
GT	=	Glass Temperature	47.47 F
CRF_g	=	Condensation resistance factor – Glass	68
		$CRF_g = (GT - T_c) / (T_h - T_c) \times 100$	
CRF_f	=	Condensation resistance factor – Frame	72
		$CRF_f = (FT - T_c) / (T_h - T_c) \times 100$	

The CRF number was determined to be 68 (on the size as reported). When reviewing this test data, it should be noted that the glass temperature (GT) was colder than the frame temperature (FT) therefore controlling the CRF number. Refer to the 'CRF Report' page and the 'Thermocouple Location Diagram' page of this report.

Thermal Transmittance (U_c):

T_h	=	Average warm side ambient temperature	69.80	F
T_c	=	Average cold side ambient temperature	-0.39	F
P	=	Static pressure difference across test specimen 15 mph dynamic perpendicular wind at exterior	0.00	psf
Nominal sample area			43.07	ft^2
Total measured input to calorimeter			1414.67	Btu/hr
Calorimeter correction			106.30	Btu/hr
Net specimen heat loss			1308.37	Btu/hr
U_c	=	Thermal Transmittance	0.43	$Btu/hr \cdot ft^2 \cdot F$

Glazing Deflection (in.):

	Left Glazing	Right Glazing
Edge Gap Width	0.50	0.50
Estimated center gap width upon receipt of specimen in laboratory (after stabilization)	0.44	0.44
Center gap width at laboratory ambient conditions on day of testing	0.44	0.44
Center gap width at test conditions	0.38	0.38

The sample was inspected for the formation of frost or condensation, which may influence the surface temperature measurements. The sample showed no evidence of condensation/frost at the conclusion of the test.

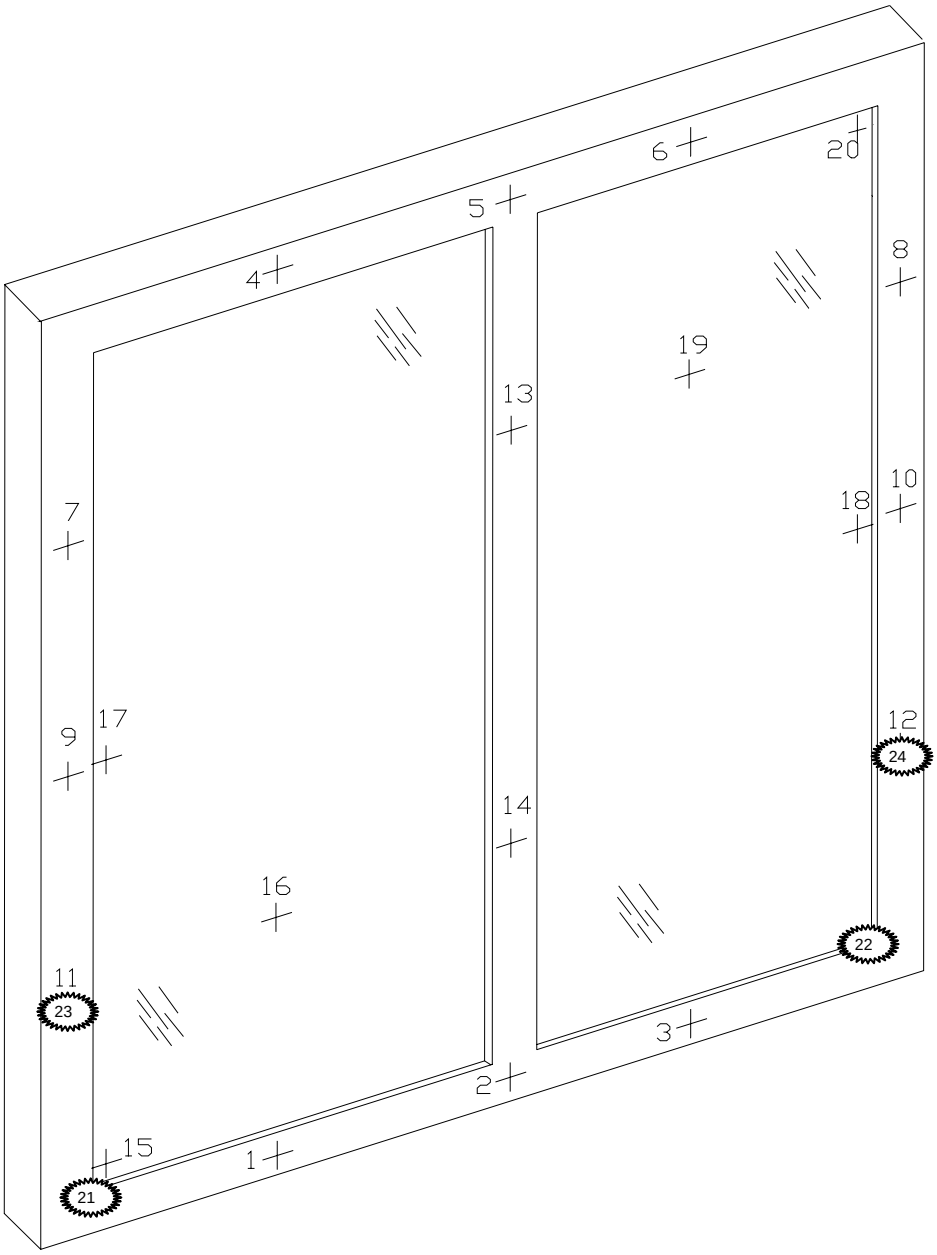
A calibration of the Architectural Testing Inc. 'thermal test chamber' (ICN 000001) in York, Pennsylvania was conducted in April 2009 in accordance with Architectural Testing Inc. calibration procedure.

Prior to testing the specimen was sealed with silicone on the interior side and checked for air infiltration per Section 9.3.4.

CRF Report

Time:	05:59	06:29	06:59	07:29	07:59	AVERAGE
Pre-specified Thermocouples - Frame						
1	47.43	47.41	47.42	47.43	47.42	47.42
2	48.23	48.22	48.23	48.24	48.23	48.23
3	47.72	47.74	47.71	47.72	47.74	47.72
4	54.19	54.17	54.18	54.20	54.18	54.18
5	53.95	53.97	53.97	53.98	53.98	53.97
6	53.76	53.76	53.77	53.75	53.77	53.76
7	52.16	52.16	52.15	52.15	52.18	52.16
8	51.88	51.87	51.87	51.87	51.86	51.87
9	49.93	49.93	49.93	49.93	49.94	49.93
10	50.20	50.23	50.21	50.22	50.20	50.21
11	46.13	46.17	46.17	46.16	46.14	46.15
12	46.97	46.99	46.97	46.97	46.99	46.98
13	55.45	55.45	55.45	55.45	55.47	55.45
14	52.11	52.10	52.12	52.11	52.10	52.11
FTP	50.72	50.73	50.72	50.73	50.73	50.73
Pre-specified Thermocouples - Glass						
15	38.71	38.58	38.67	38.64	38.61	38.64
16	52.78	52.76	52.77	52.73	52.74	52.75
17	46.19	46.24	46.21	46.19	46.22	46.21
18	46.43	46.46	46.43	46.45	46.46	46.44
19	54.05	54.07	54.05	54.03	54.05	54.05
20	46.74	46.74	46.75	46.72	46.75	46.74
GT	47.48	47.48	47.48	47.46	47.47	47.47
Cold Point (Roving) Thermocouples						
21	42.60	42.60	42.60	42.60	42.60	42.60
22	43.50	43.50	43.50	43.50	43.50	43.50
23	46.20	46.20	46.20	46.20	46.20	46.20
24	47.00	47.00	47.00	47.00	47.00	47.00
FT_R	44.83	44.83	44.83	44.83	44.83	44.83
W	0.06	0.06	0.06	0.06	0.06	0.06
FT	50.38	50.39	50.39	50.39	50.39	50.39
Warm Side - Room Ambient Air Temperature						
	69.80	69.81	69.80	69.80	69.80	69.80
Cold Side - Room Ambient Air Temperature						
	-0.37	-0.37	-0.45	-0.35	-0.35	-0.38
CRF_f	72	72	72	72	72	72
CRF_g	68	68	68	68	68	68

Thermocouple Location Diagram



Cold Point Locations

21. 42.60
22. 43.50
23. 46.20
24. 47.00

Detailed drawings, data sheets, representative samples of the test specimens, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. until 8/15/2013. At the end of this retention period such materials shall be discarded without notice and the service life of this report by Architectural Testing, Inc. will expire.

Results obtained are tested values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen(s) tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.

Digitally Signed by: Benjamin W. Green

Benjamin W. Green
Technician

Digitally Signed by: Shon W. Einsig

Shon W. Einsig
Senior Technician
Individual-In-Responsible-Charge

BWG:kmm
93842.02-116-46

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix-A: Description Table Abbreviations (1)
Appendix-B: Drawings (2)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
.02R0	10/20/09	All	Original Report Issue. Work requested by Don Pangburn of YKK AP America.

Appendix A: Description Table Abbreviations

CODE	Frame / Sash Types
AI	Aluminum w/ Vinyl Inserts (Caps)
AL	Aluminum
AP	Aluminum w/ Thermal Breaks - Partial
AS	Aluminum w/ Steel Reinforcement
AT	Aluminum w/ Thermal Breaks - All Members (≥ 0.21")
AU	Aluminum Thermally Improved - All Members (0.062" - 0.209")
AV	Aluminum / Vinyl Composite
AW	Aluminum-clad Wood
FG	Fiberglass
PA	ABS Plastic w/ All Members Reinforced
PC	ABS Plastic-clad Aluminum
PF	ABS Plastic w/ Foam-filled Insulation
PH	ABS Plastic w/ Horizontal Members Reinforced
PI	ABS Plastic w/ Reinforcement - Interlock
PL	ABS Plastic
PP	ABS Plastic w/ Reinforcement - Partial
PV	ABS Plastic w/ Vertical Members Reinforced
PW	ABS Plastic-clad Wood
ST	Steel
VA	Vinyl w/ All Members Reinforced
VC	Vinyl-clad Aluminum
VF	Vinyl w/ Foam-filled Insulation
VH	Vinyl w/ Horizontal Members Reinforced
VI	Vinyl w/ Reinforcement - Interlock
VP	Vinyl w/ Reinforcement - Partial
VV	Vinyl w/ Vertical Members Reinforced
VW	Vinyl-clad Wood
VY	Vinyl
WA	Aluminum / Wood composite
WD	Wood
WV	Vinyl / Wood composite
WF	Fiberglass/Wood Combination
WC	Composite/Wood Composite (Shaped vinyl/wood composite members)
CW	Copper Clad Wood
CO	Vinyl/Wood Composite Material

CODE	Spacer Types (See sealant)
A1	Aluminum
A2	Aluminum (Thermally-broken)
A3	Aluminum-reinforced Polymer
A4	Aluminum / Wood
A5	Aluminum-reinforced Butyl (Swiggle)
A6	Aluminum / Foam / Aluminum
A7	Aluminum U-shaped
A8	Aluminum-Butyl (Corrugated) (Duraseal)
ER	EPDM Reinforced Butyl
FG	Fiberglass
GL	Glass
OF	Organic Foam
P1	Duralite
PU	Polyurethane Foam
SU	Stainless Steel, U-shaped
CU	Coated Steel, U-shaped (Intercept)
S2	Steel (Thermally-broken)
S3	Steel / Foam / Steel
S5	Steel-reinforced Butyl
S6	Steel U-channel w/ Thermal Cap
SS	Stainless Steel
CS	Coated Steel
TP	Thermo-plastic
WD	Wood
ZE	Elastomeric Silicone Foam
ZF	Silicone Foam
ZS	Silicone / Steel
N	Not Applicable
TS	Thermo-plastic w/ stainless steel substrate

CODE	Tint Codes
AZ	Azurlite
BL	Blue
BZ	Bronze
CL	Clear
EV	Evergreen
GD	Gold
GR	Green
GY	Gray
LE	Low 'e' Coating
OT	Other (use comment field)
RC	Solar or Reflective Coating
RG	Roller Shades between glazing
RS	Silver (reflective coating)
SF	Suspended Polyester Film
SR	Silver
BG	Blinds between the Glazing
DV	Dynamic Glazing-Variable
DY	Dynamic Glazing-NonVariable

CODE	Gap Fill Codes
AIR	Air
AR2	Argon/Krypton Mixture
AR3	Argon / Krypton / Air
ARG	Argon/Air
CO2	Carbon Dioxide
KRY	Krypton/Air
SF6	Sulfur Hexaflouride
XE2	Xenon/Krypton/Air
XE3	Xenon/Argon/Air
XEN	Xenon/Air
N	Not Applicable

DOOR DETAILS	
N	Not Applicable
CODE	Door Type
EM	Embossed
FL	Flush
LF	Full Lite
LH	1/2 - Lite
LQ	1/4 - Lite
LT	3/4 - Lite
RP	Raised Panel
CODE	Skin
AL	Aluminum
FG	Fiberglass
GS	Galvanized Steel
ST	Steel
WD	Wood
VY	Vinyl
CODE	Panel
FG	Fiberglass
PL	Plastic
WP	Wood - Plywood
WS	Wood - Solid
CODE	Sub-Structure
GS	Galvanized Steel
ST	Steel
WD	Wood
VY	Vinyl
CODE	Core Fill
CH	Cellular - Honeycomb
EP	Expanded Polystyrene
PI	Polyisocyanurate
PU	Polyurethane
WP	Wood - Plywood
WS	Wood - Solid
XP	Extruded Polystyrene

CODE	Spacer Sealant
D	Dual Seal Spacer System
S	Single Seal Spacer System

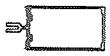
CODE	Grid Description
N	No Muntins
G	Grids between glass
S	Simulated Divided Lites
T	True Muntins

CODE	Grid Size Codes
	Blank for no grids
0.75	Grids < 1"
1.5	Grids >= 1"

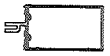
CODE	Thermal Breaks
F	Foam
U	Urethane
V	Vinyl
FB	Fiberglass
O	Other
AB	ABS
NE	Neoprene
AI	Air
N	Not Applicable
P	Polyamide

Appendix B: Drawings

YHC300 OG THERMAL & ACOUSTICAL TEST



(2) S/L'S E9-3101 MULLION (6) AT 78 3/4"



(1) S/L E9-3102 HORIZ. (8) AT 34 7/8"

(3) S/L'S E9-3172 PR. PL. (6) AT 78 3/4"
(8) AT 34 3/4"

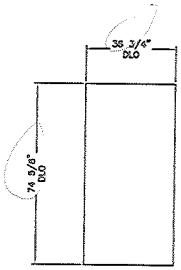
(3) S/L'S E9-3161 COVER (6) AT 78 3/4"
(8) AT 34 13/16"

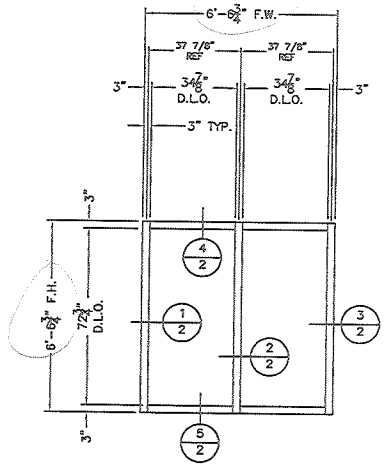
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 93842.01

Date 10/20/00 Tech BWG





ELEVATION
SCALE: 1/2" = 1'-0"
QTY: 1

A

FINISHES:
EXT: PAINTED
INT: PAINTED
YKK SYSTEM(S): YHC300 OG

THERMAL TEST MOCKUP FOR AAMA 1503-98
GLASS SIZE: (2) 36 3/4" X 74 5/8"
GLASS TYPE: IGU (1/4" Temp. X 1/2" AIR X 1/4"
Heat str. , 0.060 PVB + 1/4" Clr. Ht. Strengthened)
PPG Solarban 60 (2)

ACOUSTICAL TEST MOCKUP FOR ASTM E-90
GLASS SIZE: (2) 36 3/4" X 74 5/8"
GLASS TYPE: IGU (1/4" Temp. X 1/2" AIR X 1/4"
Heat str. , 0.060 PVB + 1/4" Clr. Ht. Strengthened)

YKK AP America Inc.
7650 The Bluffs, Suite 100
Austell, GA 30168
(PH) 678/838-6000
(FAX) 678/838-6066

PROJECT NAME AND LOCATION: YCW750 OG3 THERMAL TEST

DESCRIPTION:

SCALE: As Noted

ISSUE DATE: 05/22/06

DRAWN BY: dp

CHECKED BY:

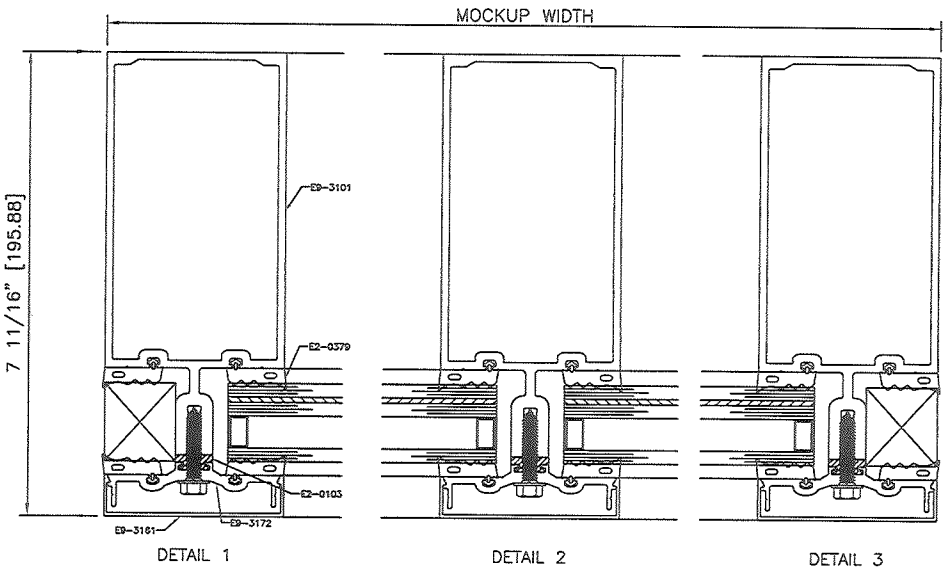
SHEET NO.: 1

Architectural Testing

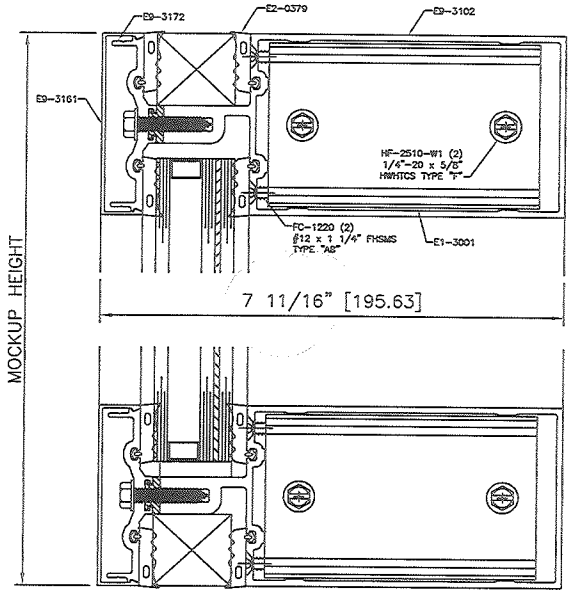
Test sample complies with these details.
Deviations are noted.

Report# 93842.01

Date 10/20/09 Tech Bub



DETAIL 1 DETAIL 2 DETAIL 3



DETAIL 4

DETAIL 5

ALL DETAILS: HALF SCALE

YKK AP

YKK AP AMERICA INC.
HEADQUARTERS: 7629 The Bluffs, Suite 100 Austell, GA 30168 PH:(678)838-6000 FAX:(678)838-6068
DUBLIN PLANT: 332 Fleshner Road Dublin, GA 31021 PH:(478)277-1953 FAX:(478)277-2500

NO.	REVISION	DATE	BY

DESCRIPTION: THERMAL/ACOUSTICAL DETAILS

SYSTEM: YHC 300 OG

DRAWING NUMBER

FINISH:

SCALE: As Noted | GLAZING: 1 5/16" GLASS

DRAWN BY: D.D. | REV.:

APPROVED BY: D.P. | SHEET NO.: 2

DATE: 05/04/09

M:\PRODUCT TEAMS\WALL TEAM\CURTAINWALL\YHC 300 OG\TEST DOCUMENTS\THERMAL TEST DETAILS

Architectural Testing

NFRC U-FACTOR, SHGC, VT, & CONDENSATION RESISTANCE COMPUTER SIMULATION REPORT

Rendered to:
YKK AP AMERICA

SERIES/MODEL:
YHC 300 OG Curtain Wall

Report Number: **D5331.02-116-45**
Report Date: **03/10/14**

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Architectural Testing

NFRC U-FACTOR, SHGC, VT, & CONDENSATION RESISTANCE
COMPUTER SIMULATION REPORT

Rendered to:
YKK AP AMERICA
1229 Highway 441 Bypass
Dublin, Georgia 31021

Report Number:	D5331.02-116-45
Simulation Date:	03/10/14
Report Date:	03/10/14

Project Summary:
Architectural Testing, Inc. was contracted to perform U-Factor, Solar Heat Gain Coefficient, Visible Transmittance, and Condensation Resistance* computer simulations in accordance with the National Fenestration Rating Council (NFRC). The products were evaluated in full compliance with NFRC requirements to the standards listed below.

**NFRC's Condensation Resistance rating is NOT equivalent to a Condensation Resistance Factor (CRF) determined in accordance with AAMA 1503.*

Standards:

NFRC 100-2010:	*Procedure for Determining Fenestration Product U-Factors*
NFRC 200-2010:	*Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence*
NFRC 500-2010:	*Procedure for Determining Fenestration Product Condensation Resistance Values*

Software:

Frame and Edge Modeling:	THERM 6.3.46
Center-of-Glass Modeling:	WINDOW 6.3.74
Total Product Calculations:	WINDOW 6.3.74
Spectral Data Library:	IGDB 31.0

Simulations Specimen Description:

Series/Model:	YHC 300 OG Curtain Wall
Type:	Glazed Wall System, Curtain Wall
Frame Material:	AU Thermally Improved
Sash Material:	NA Not Applicable
Standard Size:	2000mm x 2000mm

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Modeling Assumptions/Technical Interpretations:

1) To prevent air infiltration, tape was applied to all interior sash crack locations.
2) This product is available in either a painted or anodized finish. These two finish types can be grouped in accordance with NFRC 100-2010, Section 4.2.1.L. The painted finish was simulated since it is the worst case (highest emissivity). The test sample was painted aluminum.
3) The center-line modeling approach was conducted using the horizontal intermediate for the head and sill models, and the vertical intermediate for the jambs. This procedure is outlined in the NFRC Simulation Manual, Section 8.10.
4) This product is available with a dry glazed or wet glazed sealant. These sealant variations were grouped for worst case performance in accordance with NFRC 100-2010, Section 4.2.1.M. The dry glazed version of this product was simulated as the group leader since it is the worst case (highest conductivity).

Specialty Products Table:

The specialty products method allow the manufacturer to determine the overall product SHGC and VT for any glazing option. The center of glass SHGC and/or VT must be determined using WINDOW 6.3.74. The method gives overall product SHGC and VT indexed on center of glass properties. All values used in the calculations are truncated to six decimal place precision.

	No Dividers	Dividers < 1	Dividers > 1
SHGC0	0.016260	0.019669	0.022865
SHGC1	0.899578	0.798804	0.704349
VT0	0.000000	0.000000	0.000000
VT1	0.883318	0.779135	0.681484

SHGC = SHGC0 + SHGCc (SHGC1 - SHGC0)

VT = VT0 + VTc (VT1 - VT0)

Validation Matrix:

The following products are part of a validation matrix. Only one is required for validation testing.

Product Line	*Report Number*
None	-

Spacer Option Description

	Sealant		
Spacer Type	*Primary*	*Secondary*	*Code*
Aluminum Dual Seal Spacer	Butyl Rubber	Butyl Rubber	A1-D

Reinforcement Option Description

Location	*Material*
None	-

Gas Filling Technique Description

Fill Type	*Method*
44.70% Argon	Single Probe Timed
67.04% Krypton	Single Probe Timed
63.43% Krypton	Single Probe Timed
60.69% Krypton	Single Probe Timed
76.82% Krypton	Single Probe Timed
77.20% Argon	Single Probe Timed
79.35% Krypton	Single Probe Timed
67.85% Krypton	Single Probe Timed
86.88% Argon	Single Probe Timed
80.58% Krypton	Single Probe Timed
71.74% Krypton	Single Probe Timed
88.42% Krypton	Single Probe Timed
94.25% Xenon	Evacuated Chamber
59.50% Krypton	Single Probe Timed
76.46% Krypton	Single Probe Timed
87.96% Krypton	Single Probe Timed
76.00% Xenon	Evacuated Chamber
81.42% Xenon	Evacuated Chamber

Edge-of-Glass Construction

Interior Condition	EPDM Gasket Between Aluminum Frame and Glass
Exterior Condition	EPDM Gasket Between Aluminum Pressure Plate and Glass

Weatherstripping

Type	*Quantity*	*Location*
None	-	-

Frame/Sash Materials Finish

Interior	Painted Aluminum
Exterior	Painted Aluminum

NFRC 100/200/500 Summary Sheet
YHC 300 OG Curtain Wall

ID	Pane Thickness 1	Gap Width 1	Pane Thickness 2	Gap Width 2	Pane Thickness 3	Gap Width 3	Pane Thickness 4	Gap Fill	Low-e (Surface#)	Tint	Spacer	Grid Type
	U-Factor			Solar Heat Gain Coefficient (SHGC) Grids (None / <1 / >=1)					Visible Transmittance (VT) Grids (None / <1 / >=1)		Condensation Resistance	
1	COG=.4400											
	0.225	0.500	0.539					ARG45		CL	A1-D	N
	U-Factor		0.57	SHGC (N)				0.60	VT (N)	0.68	CR	45
2	COG=.4200											
	0.230	0.500	0.539					KRY67	0.772(#2)	SR	A1-D	N
	U-Factor		0.55	SHGC (N)				0.51	VT (N)	0.49	CR	46
3	COG=.4000											
	0.223	0.500	0.539					KRY63	0.640(#2)	CL	A1-D	N
	U-Factor		0.54	SHGC (N)				0.25	VT (N)	0.19	CR	47
4	COG=.3800											
	0.223	0.500	0.539					KRY61	0.525(#2)	CL	A1-D	N
	U-Factor		0.52	SHGC (N)				0.18	VT (N)	0.11	CR	48
5	COG=.3600											
	0.236	0.500	0.539					KRY77	0.465(#2)	RC	A1-D	N
	U-Factor		0.50	SHGC (N)				0.19	VT (N)	0.13	CR	49
6	COG=.3400											
	0.223	0.500	0.539					ARG77	0.351(#2)	RC	A1-D	N
	U-Factor		0.49	SHGC (N)				0.13	VT (N)	0.04	CR	49
7	COG=.3200											
	0.221	0.500	0.539					KRY79	0.302(#2)	CL	A1-D	N
	U-Factor		0.47	SHGC (N)				0.63	VT (N)	0.69	CR	51
8	COG=.3000											
	0.221	0.500	0.539					KRY68	0.206(#2)	BL	A1-D	N
	U-Factor		0.46	SHGC (N)				0.45	VT (N)	0.53	CR	52
9	COG=.2800											
	0.221	0.500	0.539					ARG87	0.149(#2)	CL	A1-D	N
	U-Factor		0.44	SHGC (N)				0.28	VT (N)	0.34	CR	53
10	COG=.2600											
	0.221	0.500	0.539					KRY81	0.107(#2)	CL	A1-D	N
	U-Factor		0.42	SHGC (N)				0.53	VT (N)	0.63	CR	55

NFRC 100/200/500 Summary Sheet
YHC 300 OG Curtain Wall

ID	Pane Thickness 1	Gap Width 1	Pane Thickness 2	Gap Width 2	Pane Thickness 3	Gap Width 3	Pane Thickness 4	Gap Fill	Low-e (Surface#)	Tint	Spacer	Grid Type
	U-Factor			Solar Heat Gain Coefficient (SHGC) Grids (None / <1 / >=1)					Visible Transmittance (VT) Grids (None / <1 / >=1)		Condensation Resistance	
11	COG=.2400											
	0.222	0.500	0.539					KRY72	0.034(#2)	CL	A1-D	N
	U-Factor		**0.41**	**SHGC (N)**				**0.32**	**VT (N)**	**0.56**	**CR**	**56**
12	COG=.2200											
	0.223	0.500	0.539					KRY88	0.018(#2)	CL	A1-D	N
	U-Factor		**0.39**	**SHGC (N)**				**0.25**	**VT (N)**	**0.55**	**CR**	**57**
13	COG=.2000											
	0.223	0.500	0.539					XEN94	0.018(#2)	CL	A1-D	N
	U-Factor		**0.37**	**SHGC (N)**				**0.25**	**VT (N)**	**0.55**	**CR**	**56**
14	COG=.1800											
	0.221	0.250	0.003	0.250	0.539			KRY77	0.302(#2) / 0.76(#3) / 0.11(#4)	CL	A1-D	N
	U-Factor		**0.35**	**SHGC (N)**				**0.47**	**VT (N)**	**0.61**	**CR**	**60**
15	COG=.1600											
	0.223	0.250	0.003	0.250	0.539			KRY76	0.087(#2) / 0.76(#3) / 0.11(#4)	CL	A1-D	N
	U-Factor		**0.34**	**SHGC (N)**				**0.41**	**VT (N)**	**0.58**	**CR**	**60**
16	COG=.1400											
	0.223	0.250	0.003	0.250	0.539			KRY88	0.035(#2) / 0.76(#3) / 0.11(#4)	CL	A1-D	N
	U-Factor		**0.32**	**SHGC (N)**				**0.31**	**VT (N)**	**0.53**	**CR**	**60**
17	COG=.1200											
	0.223	0.250	0.003	0.250	0.539			XEN76	0.018(#2) / 0.76(#3) / 0.11(#4)	CL	A1-D	N
	U-Factor		**0.30**	**SHGC (N)**				**0.23**	**VT (N)**	**0.48**	**CR**	**60**
18	COG=.1000											
	0.223	0.250	0.003	0.250	0.539			XEN96	0.018(#2) / 0.76(#3) / 0.11(#4)	CL	A1-D	N
	U-Factor		**0.29**	**SHGC (N)**				**0.23**	**VT (N)**	**0.48**	**CR**	**61**

The Condensation Resistance results obtained from this procedure are for controlled laboratory conditions and do not include the effects of air movement through the specimen, solar radiation, and the thermal bridging that may occur due to the specific design and construction of the fenestration system opening.

Ratings values included in this report are for submittals to an NFRC-licensed IA and are not meant to be used directly for labeling purposes. Only those values identified on a valid Certification Authorization Report (CAR) by an NFRC accredited Inspection Agency (IA) are to be used for labeling purposes. The ratings values were rounded in accordance to NFRC 601, NFRC Unit and Measurement Policy.

Architectural Testing, Inc. is an NFRC accredited simulation laboratory and all simulations were conducted in full compliance with NFRC approved procedures and specifications. The NFRC procedure requires that the computational results be verified through actual test results.

Architectural Testing will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Architectural Testing, Inc. for the entire test record retention period. The test record retention end date for this report is March 10, 2018.

Results obtained are simulated values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the product simulated. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

SIMULATED BY:

Allison M. Goodyear
Digitally Signed by: Allison M. Goodyear

Allison M. Goodyear
Simulation Technician

REVIEWED BY:

Michael J. Thoman
Digitally Signed by: Michael J. Thoman

Michael J. Thoman
Director - Simulations and Thermal Testing
Simulator-In-Responsible-Charge

AMG:amg

D5331.02-116-45

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A: Drawings and Bills of Material (10)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
.02R0	03/10/14	All	Original Report Issued to YKK AP America.

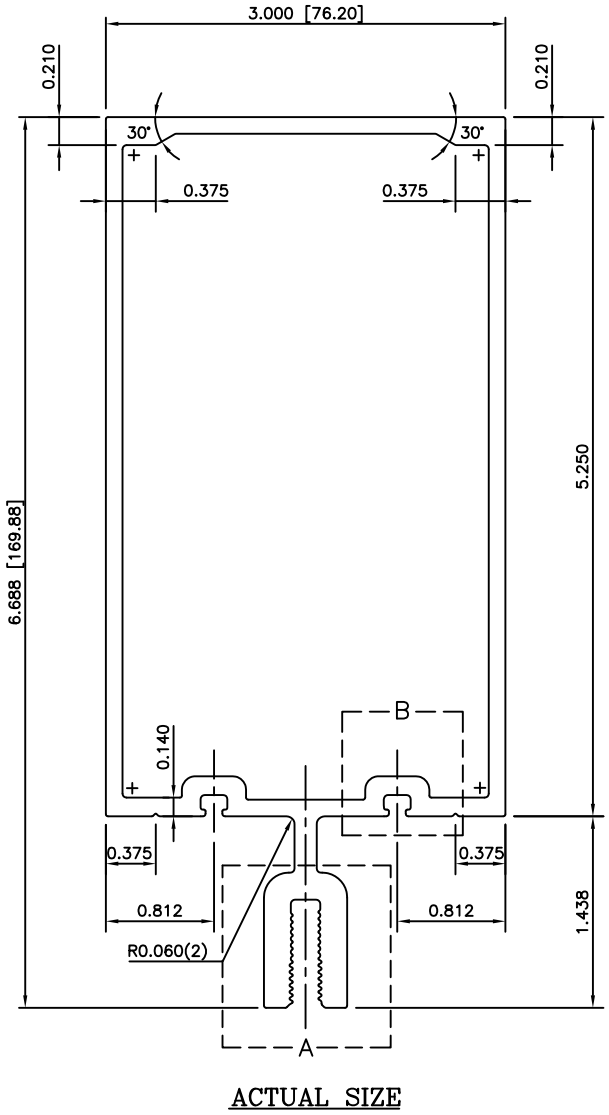
All drawings and Bills of Material used to simulate this product are enclosed in this Appendix

Appendix A

Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

YKK AP GROUP
INTERNAL USE ONLY



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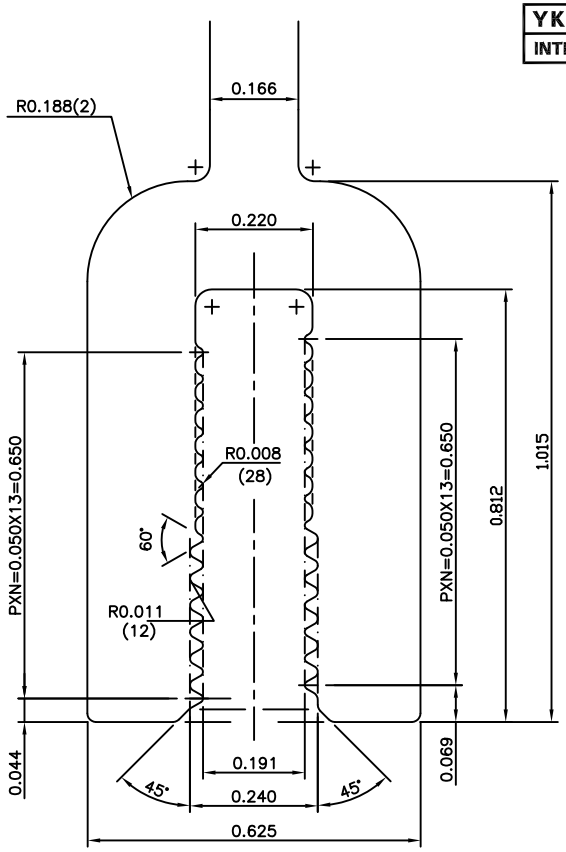
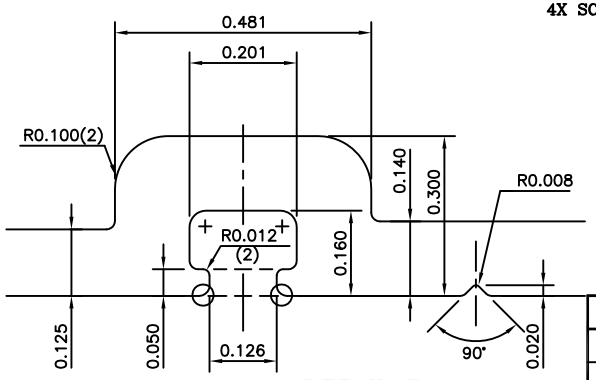


DETAIL A
4X SCALE

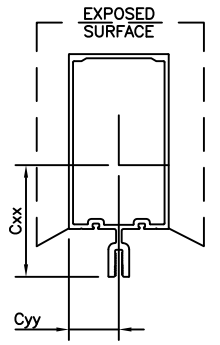


DETAIL B
4X SCALE

Material: Painted or Anodized Aluminum

E.C.	REV.	DRAWN BY	DESCRIPTION	DATE
		A.OI	ADD. DIMENSION 0.069	05/19/97
	A	D.O.	CHANGED TEMPER TO T6	06/16/05
	B	C.T.	REVISED PROPERTIES/REDRAWN	02/01/11

DRAWING NUMBER E9-3101 B



GENERAL NOTES

1) 0.125"[3.18mm] TYP. WALL THICKNESS UNLESS OTHERWISE SPECIFIED.
2) MATES WITH
3) 0.016" TYP. RAD. UNLESS OTHERWISE SPECIFIED.
4) CROSS (+) INDICATES 0.031" RAD.
5) CIRCLE (O) INDICATES 0.020" RAD.
6) SYMBOL (⌐) INDICATES MINIMUM RAD. OF 0.008".

MOMENT OF INERTIA (in⁴)	Ixx	13.312 [554.07cm⁴]
	Iyy	3.317 [138.05cm⁴]
SECTION MODULUS (in³)	Sxx	3.972 [65.09cm³]
	Syy	2.211 [36.23cm³]
CENTER OF GRAVITY (in)	Cxx	3.351 [8.51cm]
	Cyy	1.500 [3.81cm]
AREA (in²)		2.689 [17.35cm²]
WT./FT.		3.162 [4.705kg/m]
CIR. SIZE (in)		7.031 [17.86cm]
OS. PMTR. (in)		22.882 [58.12cm]
T. PMTR. (in)		38.645 [98.16cm]
PTD. PMTR. (in)		15.454 [39.25cm]

STANDARD A.A. TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

ALLOY AND TEMPER: 6063-T6

FINISH: PAINTED OR ANODIZED

DESCRIPTION: MULLION FOR 1" GLAZING

SYSTEM: YHC-300

SCALE: AS NOTED

DRAWING NUMBER E9-3101 B

YKK ap

DRAWN BY R.B.E.

DATE 8/22/96

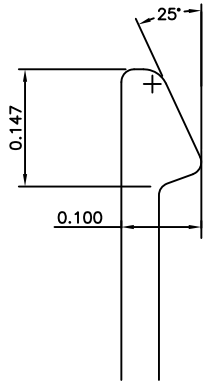
APPROVED BY J.A.

Architectural Testing

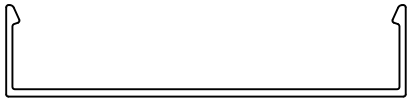
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

YKK AP GROUP
INTERNAL USE ONLY

DRAWING NUMBER E9-3161 B



DETAIL A
6X SCALE



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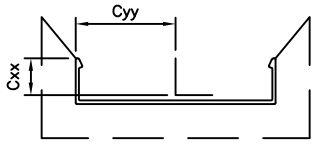
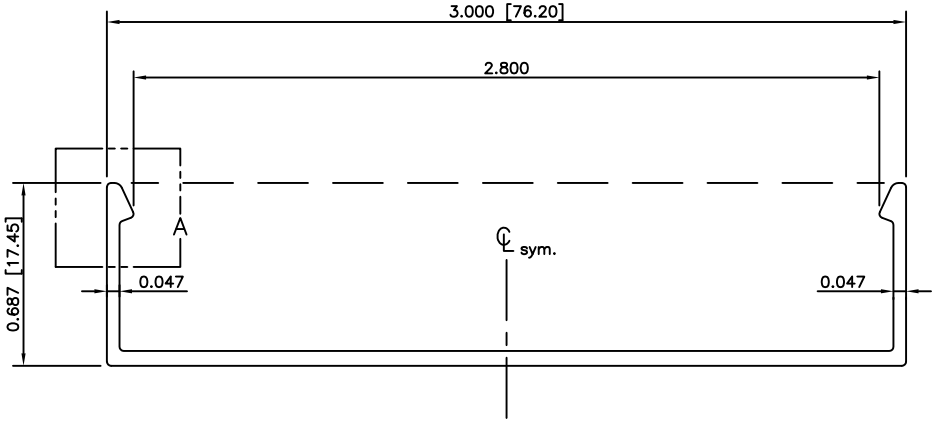




2X SCALE

GENERAL NOTES

1) 0.056"[1.42mm] TYP. WALL THICKNESS UNLESS OTHERWISE SPECIFIED.
2) MATES WITH E9-3131, E9-3132.
3) 0.016" TYP. RAD. UNLESS OTHERWISE SPECIFIED.
4) CROSS (+) INDICATES 0.031" RAD.
5) CIRCLE (O) INDICATES 0.020" RAD.
6) SYMBOL (⌐) INDICATES MINIMUM RAD. OF 0.008".

MOMENT OF INERTIA (in⁴)	Ixx	0.009 [0.38cm⁴]
	Iyy	0.272 [11.34cm⁴]
SECTION MODULUS (in³)	Sxx	0.016 [0.27cm³]
	Syy	0.182 [2.98cm³]
CENTER OF GRAVITY (in)	Cxx	0.552 [1.40cm]
	Cyy	1.500 [3.81cm]
AREA (in²)		0.236 [1.52cm²]
WT./FT.		0.277 [0.412kg/m]
CIR. SIZE (in)		3.071[7.80cm]
OS. PMTR. (in)		8.673 [22.03cm]
T. PMTR. (in)		8.673 [22.03cm]
PTD. PMTR. (in)		5.353 [13.60cm]

STANDARD A.A. TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

ALLOY AND TEMPER: 6063-T5

FINISH: PAINTED OR ANODIZED

DESCRIPTION: SNAP COVER

SYSTEM: YHC 300

SCALE: AS NOTED

E.C.	REV.	DRAWN BY	DESCRIPTION	DATE
	A	R.B.E.	REDESIGNED & REDRAWN	10/24/96
		A.OI	REV. DIM. FROM 0.153 TO 0.147	06/03/97
	B	C.T.	REVISED PROPERTIES/REDRAWN	02/02/11

Material: Painted or Anodized Aluminum

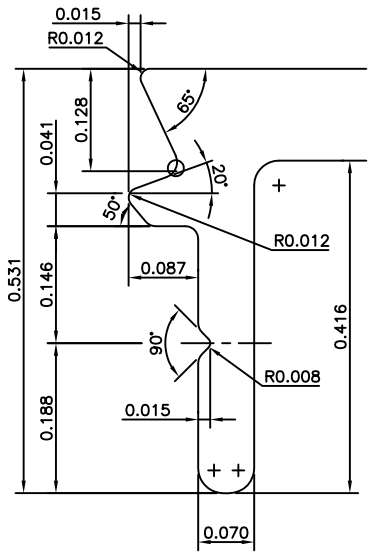
DRAWING NUMBER E9-3161 B

YKK ap

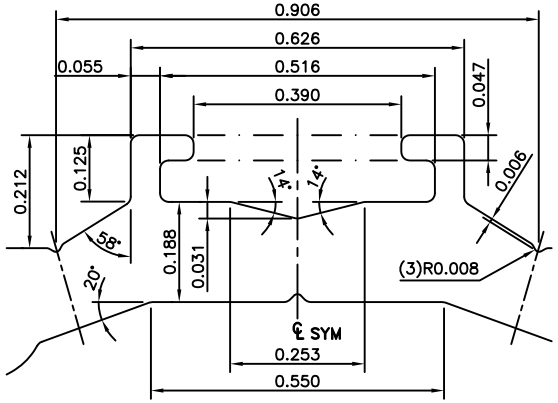
DRAWN BY R.B.E.
DATE 08/24/96
APPROVED BY J.I.A.

Architectural Testing

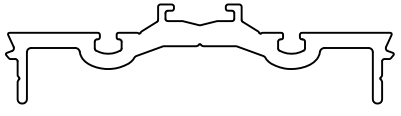
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear



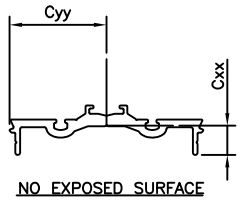
DETAIL A
6X SCALE



DETAIL C
4X SCALE



ACTUAL SIZE



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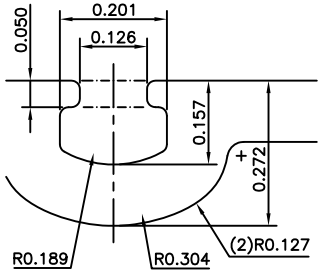
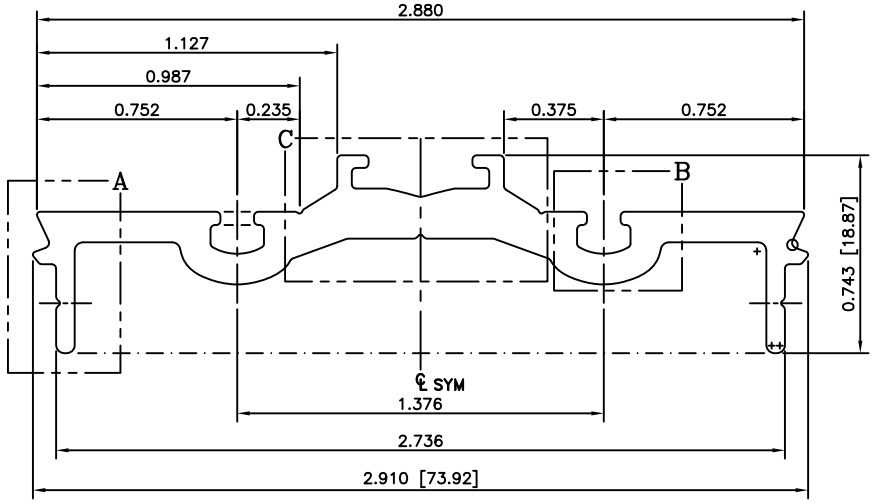


DETAIL B
4X SCALE



2X SCALE

GENERAL NOTES

1) 0.115"[2.92mm] TYP. WALL THICKNESS UNLESS OTHERWISE SPECIFIED.
2) MATES WITH E9–3161.
3) 0.016" TYP. RAD. UNLESS OTHERWISE SPECIFIED.
4) CROSS (+) INDICATES 0.031" RAD.
5) CIRCLE (O) INDICATES 0.020" RAD.
6) SYMBOL (⌐) INDICATES MINIMUM RAD. OF 0.008".

MOMENT OF INERTIA (in⁴)	Ixx	0.008 [0.33cm⁴]
	Iyy	0.376 [15.65cm⁴]
SECTION MODULUS (in³)	Sxx	0.018 [0.30cm³]
	Syy	0.258 [4.23cm³]
CENTER OF GRAVITY (in)	Cxx	0.439 [1.12cm]
	Cyy	1.455 [3.70cm]
AREA (in²)		0.535 [3.45cm²]
WT./FT.		0.629 [0.935kg/m]
CIR. SIZE (in)		2.910 [7.39cm]
OS. PMTR. (in)		9.400 [23.87cm]
T. PMTR. (in)		9.400 [23.87cm]
PTD. PMTR. (in)		[cm]

STANDARD A.A. TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

ALLOY AND TEMPER: 6063–T5

FINISH: MILL

DESCRIPTION: PRESSURE PLATE FOR 1 5/16" GLASS

SYSTEM: YHC 300 OG

SCALE: AS NOTED

E.C.	REV.	DRAWN BY	DESCRIPTION	DATE

Material: Painted or Anodized Aluminum

DRAWING NUMBER E9–3172

YKK AP

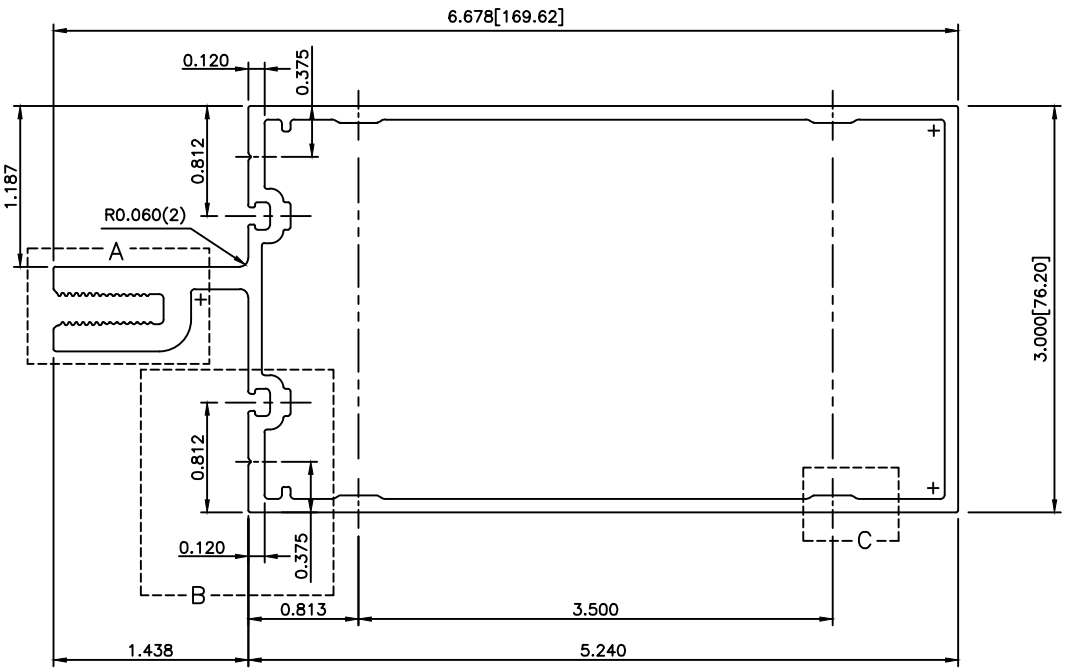
DRAWN BY D.O.
DATE 11/12/08
APPROVED BY D.P.

DRAWING NUMBER E9–3172

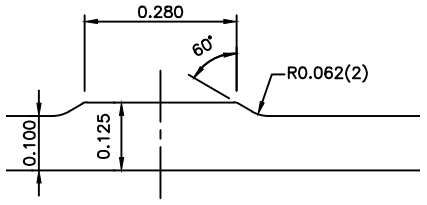
Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Hoodjer

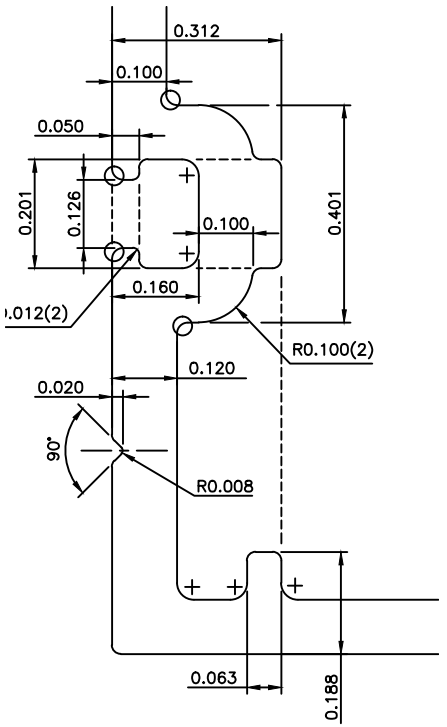
YKK AP GROUP
INTERNAL USE ONLY



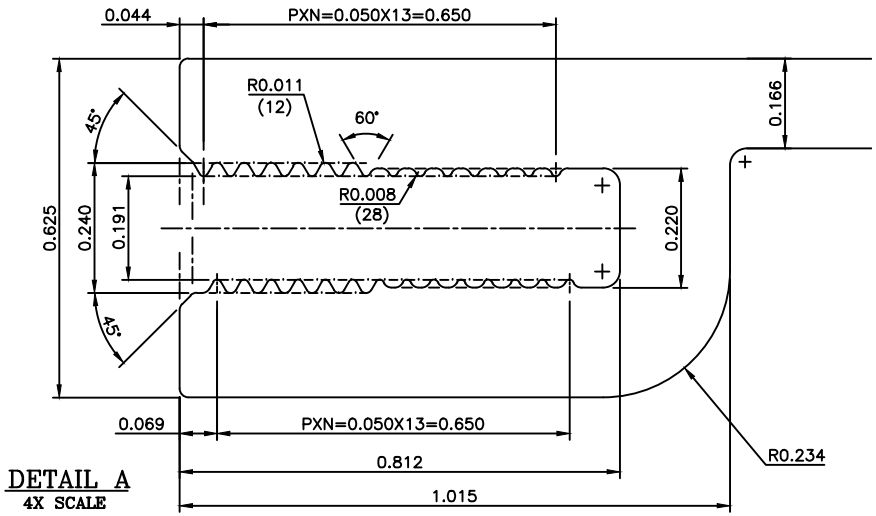
ACTUAL SIZE



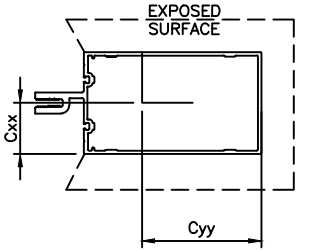
DETAIL C
4X SCALE



DETAIL B
4X SCALE



DETAIL A
4X SCALE



DRAWING NUMBER E9-3102 B

GENERAL NOTES

1) 0.100"[2.54 mm] TYP. WALL THICKNESS UNLESS OTHERWISE SPECIFIED.
2) MATES WITH
3) 0.016" TYP. RAD. UNLESS OTHERWISE SPECIFIED.
4) CROSS (+) INDICATES 0.031" RAD.
5) CIRCLE (O) INDICATES 0.020" RAD.
6) SYMBOL (⌐) INDICATES MINIMUM RAD. OF 0.008".

MOMENT OF INERTIA (in⁴)	Ixx	2.746 [114.29cm⁴]
	Iyy	11.166 [464.75cm⁴]
SECTION MODULUS (in³)	Sxx	1.820 [29.82cm³]
	Syy	3.168 [51.92cm³]
CENTER OF GRAVITY (in)	Cxx	1.509 [3.83cm]
	Cyy	3.524 [8.95cm]
AREA (in²)		2.277 [14.69cm²]
WT./FT.		2.678 [3.985kg/m]
CIR. SIZE (in)		7.021[17.83cm]
OS. PMTR. (in)		22.937 [58.26cm]
T. PMTR. (in)		39.393 [100.06cm]
PTD. PMTR. (in)		15.434 [39.20cm]

STANDARD A.A. TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

ALLOY AND TEMPER: 6063-T5

FINISH: PAINTED OR ANODIZED

DESCRIPTION: HORIZONTAL FOR 1" GLAZING

SYSTEM: YHC-300

SCALE: AS NOTED

E.C.	REV.	DRAWN BY	DESCRIPTION	DATE
	A	R.B.E.	REV. DIM. FROM 0.300 TO 0.312, 0.125 TO 0.120 & ADDED NUBS.	04/29/97
	B	C.T.	REVISED PROPERTIES/REDRAWN	02/01/11

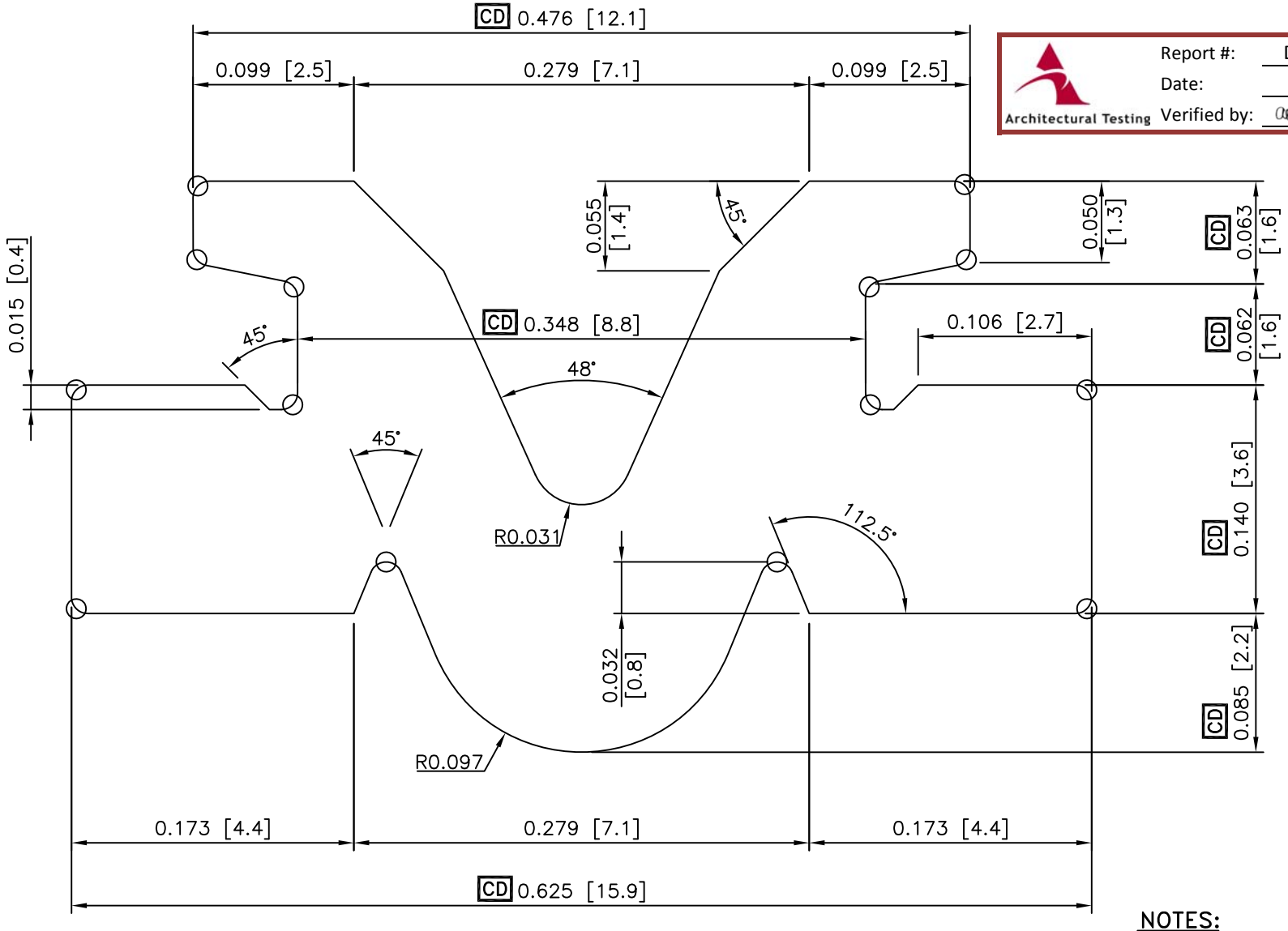
DRAWING NUMBER E9-3102 B

YKK ap

DRAWN BY R.B.E.
DATE 08/22/96
APPROVED BY J.A.

Material: Painted or Anodized Aluminum

E2-0103 | F



10X SCALE

Architectural Testing
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

ACTUAL SIZE

NOTES:
CD MARK INDICATES RMA CLASS 1.
CIRCLE (O) INDICATES 0.010" [0.3] RAD.

REV.	DESCRIPTION	BY	DATE
C	REVISED DIMS. & TOL. (REDRAWN)	A.OI	3/26/99
D	REVISED DESIGN (REDRAWN)	A.OI	1/8/04
E	REVISED DESIGN (REDRAWN)	dp	6/6/06
F	MATERIAL WAS PVC	dp	2/11/09

MATERIAL: F EPDM DUROMETER: 90±5
TOLERANCE: RMA CLASS 2
SYSTEM: YCW 750 OG, 750 OSS
FINISH: COLOR: BLACK
DESCRIPTION: THERMAL ISOLATOR

SCALE	DRAWN BY	DATE	APPROVED BY
10/1, 1/1	SMD	12/22/93	LFG

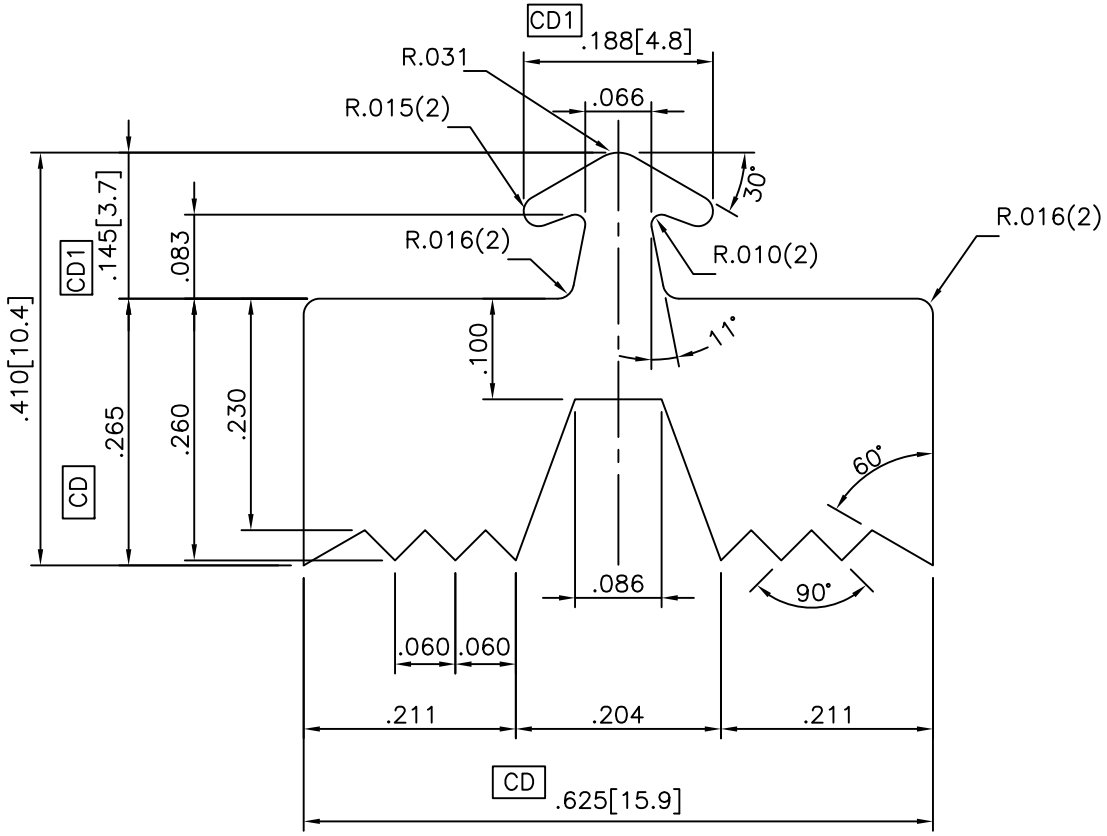
YKK AP

DRAWING NUMBER: E2-0103
REV.: F

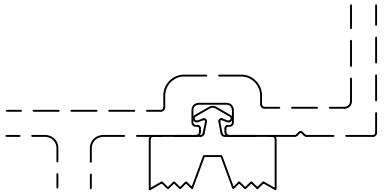
E2-0353

Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear



5X SCALE



ACTUAL SIZE

NOTE:
1) CD1 INDICATES RMA CLASS-1
2) VENDOR: TREMCO
3) COMPOUND: SCR-900

CD : CRITICAL DIMENSION

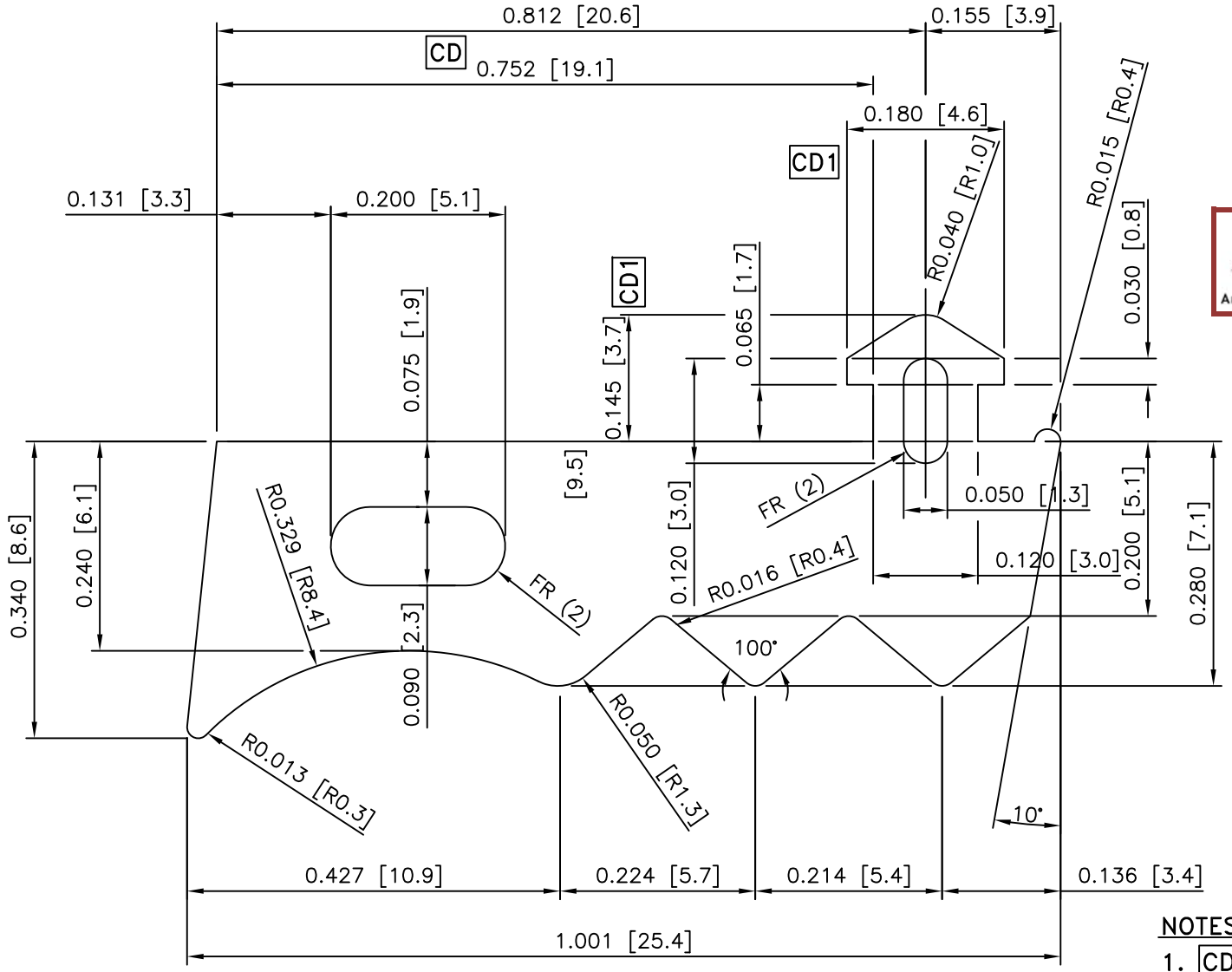
REV.	DESCRIPTION	BY	DATE

MATERIAL: EPDM (SILICONE COMPATIBLE) DUROMETER: 70±5		TOLERANCE: RMA CLASS-2	
SYSTEM: YHC 300		FINISH: COLOR: BLACK	
DESCRIPTION: GLAZING SPACER (1/4" F.C.)			
SCALE: 5/1,1/1	DRAWN BY: R.B.E.	DATE: 06/16/97	APPROVED BY: A.OI

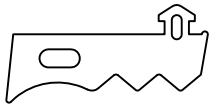
YKK ap America

DRAWING NUMBER: E2-0353
REV.

E2-0379



5X SCALE



ACTUAL SIZE

Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

NOTES:
1. CD CRITICAL DIMENSION.
2. CD1 MARK INDICATES RMA CLASS 1.
✳3. PEROXIDE CURED EPDM.

REV.	DESCRIPTION	BY	DATE

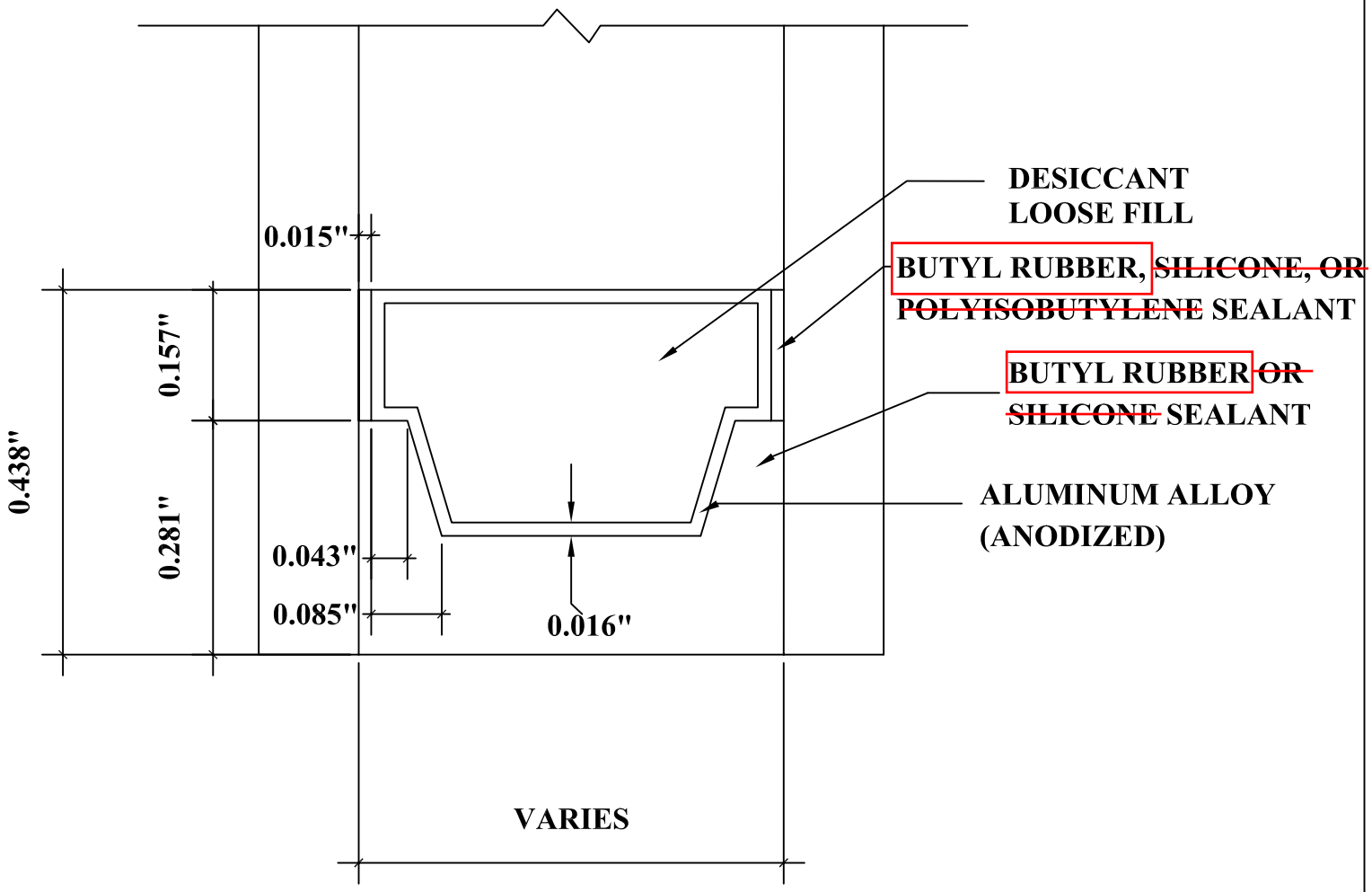
MATERIAL ✳EPDM (DUROMETER: 60±5) SILICONE COMPATIBLE		TOLERANCE RMA CLASS 2	
SYSTEM YHC 300 OG		FINISH COLOR: BLACK	
DESCRIPTION EXTERIOR/INTERIOR GASKET 0.250 F.C.			
SCALE 5/1, 1/1	DRAWN BY dp	DATE 11/20/08	APPROVED BY DP

YKK AP

DRAWING NUMBER E2-0379 | REV.

Architectural Testing

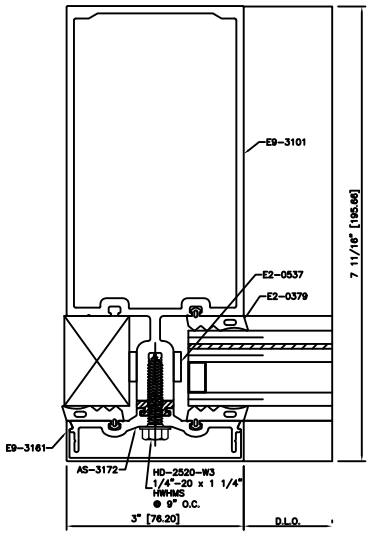
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

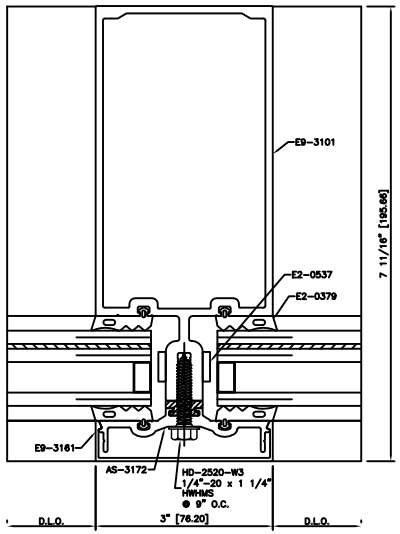


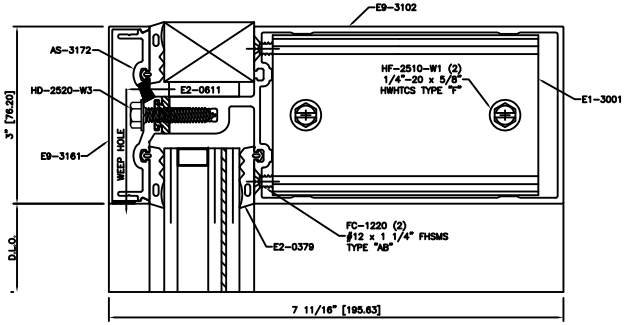
DETAIL FOR THERMAL MODELING OF
ALUMINUM SPACER (A1-D)

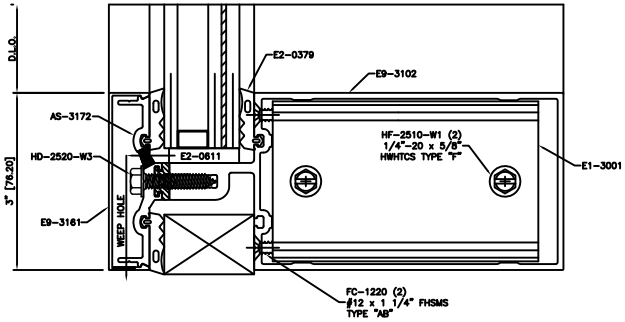
Architectural Testing

Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear









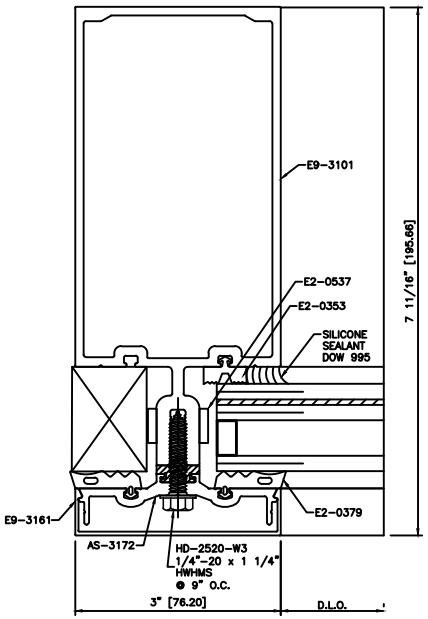
YHC 300 OG Curtain Wall - Dry Glazed

Architectural Testing

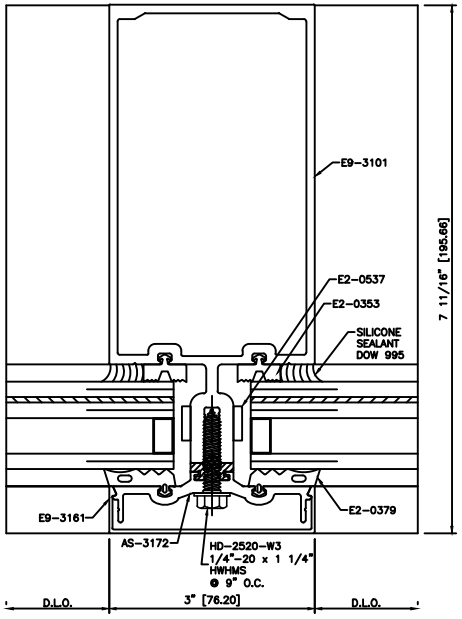
Report #: D5331-116-45
Date: 02/25/14
Verified by: Allison M. Goodyear

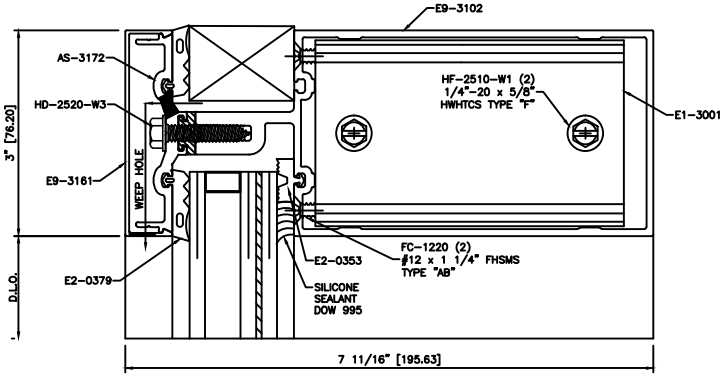
REV.	DESCRIPTION	BY	DATE

SECTION 1
HALF SCALE

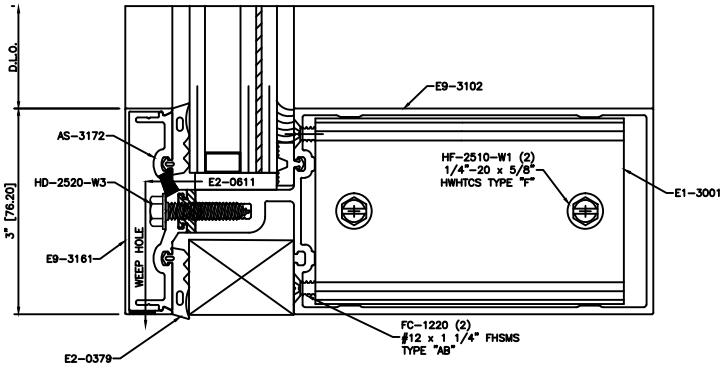


SECTION 2
HALF SCALE

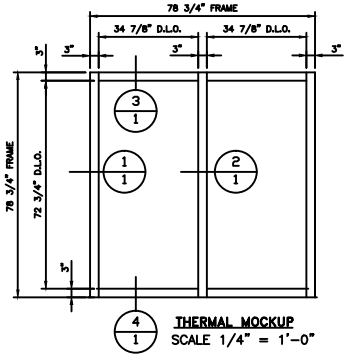




SECTION 3
HALF SCALE



SECTION 4
HALF SCALE



THERMAL MOCKUP
SCALE 1/4" = 1'-0"

YHC 300 OG Curtain Wall - Wet Glazed

YKK AP AMERICA INC.
332 FIRETOWER ROAD
DUBLIN, GEORGIA 31021

SYSTEM: YHC 300 O.G.	SCALE: AS NOTED
	GLAZING:
DESCRIPTION: THERMAL MOCK-UP TEST	
FINISH: painted	
DRAWING NUMBER: YHC 300 IG	
APPROVED BY:	DRAWN BY: PST / DATE: 10/09/13 / SHEET NO.: 1

CERTIFICATE of COMPLIANCE

OVERALL RATING	
U-Factor: (Btu/h•ft²•°F)	
SHGC:	

Directions: Fill out form completely. Determine the Overall Rating for this project by using the C.O.G. U-Factor and C.O.G. SHGC from Table 1 and looking up the overall rating from Table 2. Indicate the Overall Rating in the space above. Linear interpolation is permitted.

Certificate Authorization

Name: Company:

Signature: Date:

CERTIFIES THAT THE MATERIALS LISTED ON THIS CERTIFICATE WERE INSTALLED ON THE PROJECT IDENTIFIED BELOW.

PROJECT INFORMATION:

Street Address:

City: State: Zip:

GLAZING CONTRACTOR / INSTALLER: Contact Person:

Street Address: Phone Number:

City: State: Zip:

TABLE 1 – GLAZING

GLAZING MATERIAL SUPPLIER: Contact Person:

Street Address: Phone Number:

City: State: Zip:

Glass and Spacer Type:

Center-of-glass (C.O.G.) U-factor: Btu/h•ft²•°F Center-of-glass (C.O.G.) SHGC:

TABLE 2 – FRAMING

FRAMING MATERIAL SUPPLIER: Contact Person:

YKK AP America Inc. David Warden

Street Address: Phone Number:

270 Riverside Pkwy, Suite A 800-955-9551

City: State: Zip:

Austell GA 30168

U-factor Matrix (Btu/h•ft²•°F)		SHGC Matrix	
C.O.G. U-factor	OVERALL U-factor	C.O.G. SHGC	OVERALL SHGC
0.48	**0.60**	0.75	**0.68**
0.46	**0.59**	0.70	**0.63**
0.44	**0.57**	0.65	**0.59**
0.42	**0.55**	0.60	**0.55**
0.40	**0.54**	0.55	**0.50**
0.38	**0.52**	0.50	**0.46**
0.36	**0.50**	0.45	**0.41**
0.34	**0.49**	0.40	**0.37**
0.32	**0.47**	0.35	**0.33**
0.30	**0.46**	0.30	**0.28**
0.28	**0.44**	0.25	**0.24**
0.26	**0.42**	0.20	**0.19**
0.24	**0.41**	0.15	**0.15**
0.22	**0.39**	0.10	**0.10**
0.20	**0.37**	0.05	**0.06**

Product Line:

YHC 300 OG

The overall ratings for U-factor and SHGC are based on a size of

2000 mm x 2000 mm (78 3/4 in x 78 3/4 in) as required in NFRC 100.

Overall U-factors and Solar Heat Gain Coefficients (SHGC) listed in the matrix were determined in accordance with NFRC 100 and NFRC 200 respectively by a NFRC accredited laboratory.

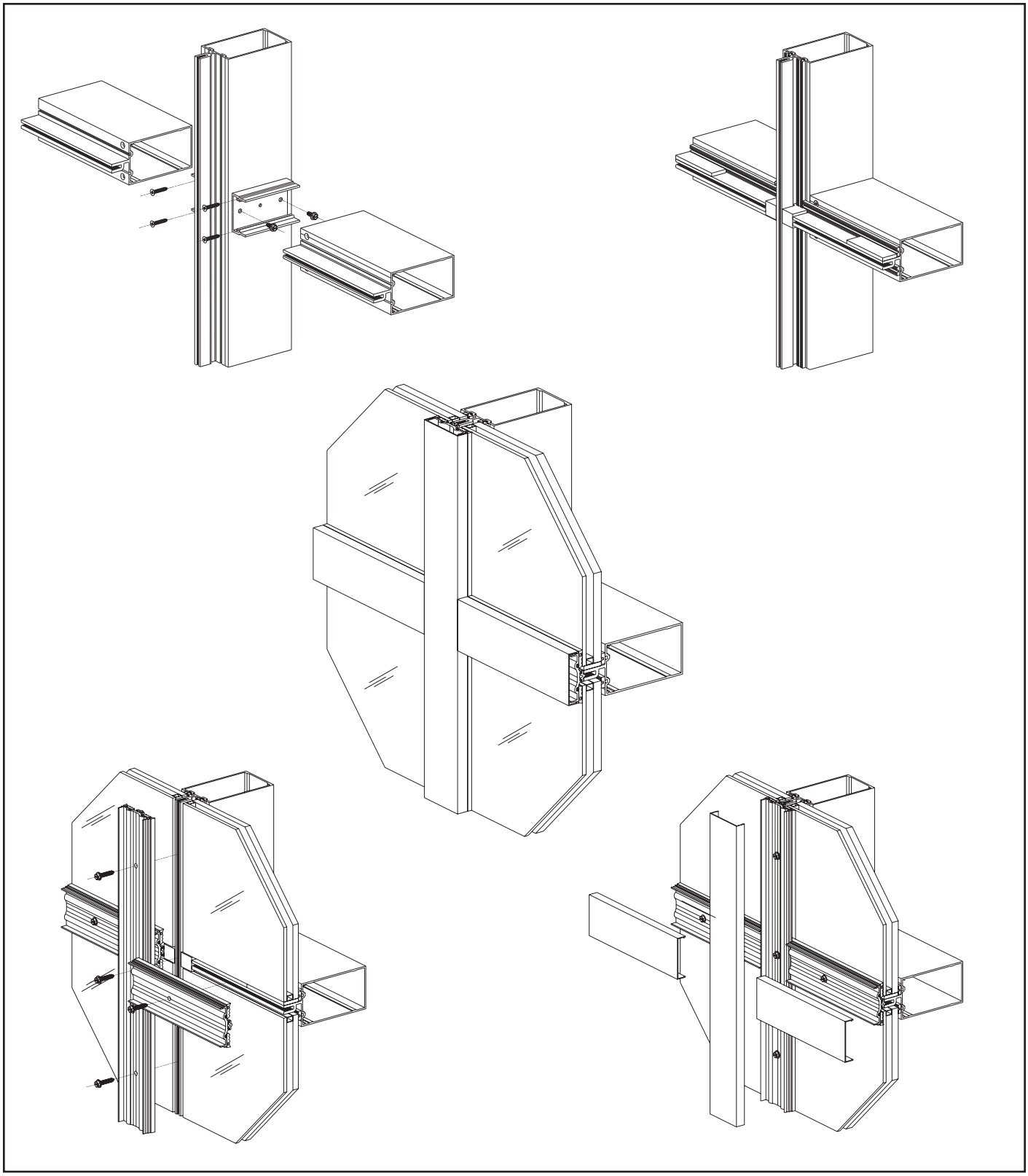
ACCREDITED LABORATORY:

Architectural Testing

Reference Test Report #:

D5331.01-116-45

YHC 300 OG Outside Glazed Curtain Wall System



Installation Manual

TABLE OF CONTENTS

Installation Notes

1. Do not drop, roll or drag boxes of aluminum framing. Move and stack boxes with proper support to prevent distortion. If fork lifts are used be especially careful about striking the boxes when lifting or moving.

2. Store in a dry, out of the way area. If rain exposure, condensation or any water contact is likely, then all packaging material should be removed. Wet packaging materials will discolor and may stain aluminum finishes and paints.

3. All materials should be checked for quantity and quality upon receipt, YKK AP must be notified immediately of any discrepancies in shipment. Check to make sure that you have the required shims, sealants, supplies, and tools necessary for the installation.

4. Carefully check the openings and surrounding conditions that will receive your material. Remember, if the construction is not per the construction documents, it is your responsibility to notify the general contractor in writing. Any discrepancies must be brought to the general contractor's attention before you proceed with the installation.

5. All work must start from, and be referenced to bench marks, offset lines and/or column centerlines established by the architectural drawings and the general contractor.

6. All vertical mullions must be installed plumb, square, level, and true, and in accordance with approved shop drawings, these installation instructions and AAMA Book 8, installation of aluminum curtain walls.

7. Gather your shop drawings, materials, packing list, and this installation manual. Carefully review parts, location, the sequence it goes therein, when you glaze it and how you seal it. Installation instructions are of a general nature and may not cover every condition you will encounter. The shop drawings and/or installation manuals were prepared specifically for the product.

8. Any material substitutions must be of equal or greater quality.

9. Make certain that material samples have been sent for compatibility testing for all manufacturer's sealants involved. Make certain that sealants have been installed in strict accordance with the manufacturer's recommendations and specifications:

A. Specified metal to metal joints use approved silicone sealant. Refer to test report for manufacturer.
B. All metal to Large Missile Impact glazing, must use approved silicone sealant. Refer to test report for manufacturer.
C. Perimeter caulk joints must use approved silicone sealant. Refer to test report for manufacturer.
D. Outside of Florida, YKK AP recommends approved silicone sealant.

Florida product approved installation must always be items A, B, and C.

Installation Notes

10. Consult sealant manufacturer for proper backer rod selection.

11. Remember to isolate, in an approved manner, all aluminum from uncured masonry or other incompatible materials.

12. System-to-structure fasteners are not supplied by YKK AP. Fasteners called out on shop drawings are to indicate minimum sizes for design loading.

13. All substrates which the framing system is anchored to must be structurally sound.

14. Entrances are to be installed plumb, square, level, and true.

15. Please contact the YKK AP DirecTech application engineering department for any project specific condition not covered by these instructions.

16. YKK AP curtain wall framing is typically completed before drywall, flooring and other products which may still be in process. Take the extra time to wrap and protect the work produced.

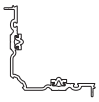
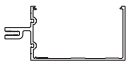
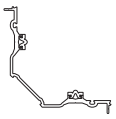
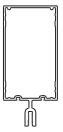
17. Concrete, mortar, plaster, muriatic acid and other alkaline and acid based construction and cleaning materials may be very harmful to finishes and should be removed with water and mild soap immediately or permanent damage or staining of the finishes will occur. A spot test is recommended before any cleaning agent is used, and abrasive type cleaners must never be used.

18. YKK AP cutting tolerances are plus zero, minus one thirty second unless otherwise noted.

19. Glass and glazing building codes governing the design and use of products vary widely. YKK AP America Inc., does not control the selection of products, product configurations, operating hardware, and function, or glazing materials, and YKK AP assumes no responsibility for these design considerations. It is the responsibility of the design professional, owner, architect, specifier, general contractor, and the installer to make these selections in strict accordance with all applicable codes.

20. Check our website, www.ykkap.com, for the latest installation manual update prior to commencing work.

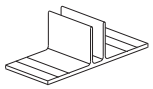
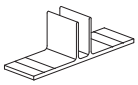
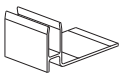
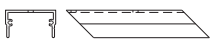
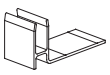
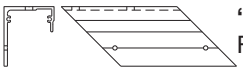
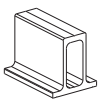
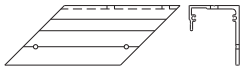
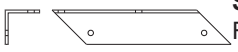
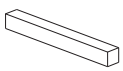
FRAMING MEMBERS (45-55 PSF)

	**Head / Sill / Horizontal** 3” x 5-1/4” For Monolithic Glazing	**E9-3105**		**Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3173**
	**Horizontal** 3” x 3-3/16” For Monolithic Glazing	**E9-8168**		**Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3172**
	**Horizontal** 3” x 3-3/16” For Monolithic Glazing	**E9-8167**		**Perimeter Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3178**
	**Mullion** 3” x 5-1/4” For Monolithic Glazing	**E9-3107**		**90° Corner Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3177**
	**Head / Sill / Horizontal** 3” x 5-1/4” For Insulating Glazing	**E9-3104**		**90° Corner Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3175**
	**Horizontal** 3” x 3-3/16” For Insulating Glazing	**E9-3112**		**Face Cover**	**E9-3161**
	**Horizontal** 3” x 3-3/16” For Insulating Glazing	**E9-3113**		**90° Outside Corner Interior Cover** Use with E9-1280	**E9-3165**
	**Mullion** 3” x 5-1/4” For Insulating Glazing	**E9-3111**		**90° Outside Corner Interior Cover Base**	**E9-1280**
	**Mullion** 3” x 3-3/16” For Insulating Glazing	**E9-3126**		**90° Outside Corner Face Cover** For Monolithic Glazing	**E9-3176**
	**Horizontal** 3” x 3-3/16” For Insulating Glazing	**E9-3127**		**90° Outside Corner Face Cover** For Insulating Glazing	**E9-3174**
	Flush Filler Use With E9-3104 and E9-3105	**E9-3162**		**Pocket Filler** For Monolithic Glazing	**E9-3109**
	Flush Filler Use With E9-3112 and E9-8168	**E9-8169**		**Pocket Filler** For Insulating Glazing	**E9-3110**

FRAMING MEMBERS (45-55 PSF)

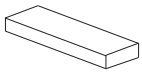
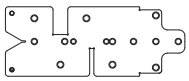
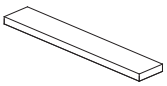
	**1-1/2” x 1-1/2” Angle**	**E9-9303**		**1/4” Glazing Adaptor**	**E9-3141**
	**Perimeter Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3179**			

ACCESSORIES (45-55 PSF)

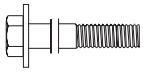
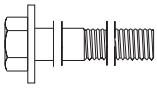
	**Shear Block** Use With E9-3104 & E9-3105	**E1-3001**		**Face Cover Splice Sleeve** Use with E9-3161	**E1-3009**
	**Shear Block** Use With E9-3112, E9-3113, E9-8167 & E9-8168	**E1-3036**		**Mullion End Cap** For Monolithic Glazing	**E1-3011**
	**"J" Anchor**	**E1-3002**		**Mullion End Cap** For Insulating Glazing	**E1-3010**
	**Intermediate Vertical Mullion End Anchor** Requires E1-3006 Anchor Sleeve	**E1-3003**		**Temporary Pressure Plate** For Monolithic Glazing	**E1-3026**
	**Intermediate Vertical Mullion End Anchor** For 3" x 3-3/16" Mullion	**E1-3046**		**Temporary Pressure Plate** For Insulating Glazing	**E1-3025**
	**Jamb Mullion End Anchor** Requires E1-3006 Anchor Sleeve	**E1-3004**		**Shear Block** For 90° Corner Mullion	**E1-3013**
	**Jamb Mullion End Anchor** For 3" x 3-3/16" Mullion	**E1-3047**		**"J" Anchor (Right Hand)** For 90° Corner Mullion	**E1-3014**
	**"T" Anchor** Use at Door Jamb	**E1-3039**		**"J" Anchor (Left Hand)** For 90° Corner Mullion	**E1-3015**
	**Mullion Splice Sleeve**	**E1-3005**		**Shear Clip (Right Hand)** For 90° Corner Mullion	**E1-3016**
	**Mullion Anchor Sleeve**	**E1-3006**		**Shear Clip (Left Hand)** For 90° Corner Mullion	**E1-3017**
	**Mullion Reinforcement Sleeve**	**E1-3007**		**Mullion End Anchor** For 90° Corner Mullion	**E1-3018**
	**2-1/2" x 2-1/2" x 1/4" Steel Reinforcement Tube** For 3" x 3-3/16" mullion	**E1-0177**		**Setting Block** For Monolithic Glazing	**E2-0623**

***Note:** Exact size of anchors should be determined from loads calculated on each individual curtain wall.

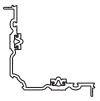
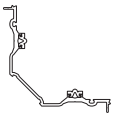
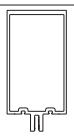
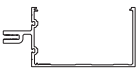
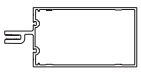
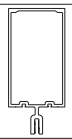
ACCESSORIES (45-55 PSF)

	**Setting Block** For Insulating Glazing	**E2-0611**		**Drill Fixture**	**H-7213**
	**Side Block**	**E2-0537**		**#8-32 x 1/2" FHTCS Type F** Zinc Plated, For Attachment of Face Cover Splice Sleeve	**FF-0808**
	**Joint Plug** For Monolithic Glazing	**E2-0358**		**#10 x 1" FHSMS Type AB** Zinc Plated, For Attachment of Monolithic Glazing Adaptor	**FC-1016**
	**Joint Plug** For Insulating Glazing	**E2-0355**		**#12 x 3/4" FHSMS Type AB** Zinc Plated, For Attachment of Mullion Splice Sleeve	**FC-1212**
	**Isolator Tape** 3/8" x 1/4" Use with Perimeter Pressure Plate	**E2-0386**		**#12 x 1-1/4" FHSMS Type AB** Zinc Plated, For Attachment of Horizontalto Shear Block	**FC-1220**
	**Wind Load / Dead Load Anchor Slip Pad**	**E3-0103**		**#14 x 5/8" FHSMS Type AB** Zinc Plated, For Attachment of Mullion End Cap	**FC-1410**
	**Wind Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1204**		**#10 x 5/8" PHSMS Type AB** Zinc Plated, For Attachment of E1-3006 Anchor Sleeve	**PC-1010**
	**Dead Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1205**		**1/4"-20 x 5/8" HWHTCS Type F,** Zinc Plated For Attachment of Shear Block to Vertical	**HF-2510-W1**
	**Interior/Exterior Glazing Gasket**	**E2-0379**		**1/4"-20 x 1" HWHMS** Zinc Plated, For Attachment of Pressure Plate to Mullion at Interior Corner	**HM-2516-W3**
	**Interior/Exterior Glazing Gasket** For 1/4" Monolithic and 1" Insulating Glass	**E2-0380**		**1/4"-20 x 1-1/4" HWHMS** Zinc Plated, For Attachment of Pressure Plate to Mullion	**HD-2520-W3**
	**Interior Glazing Silicone Spacer** For Large Missile Glazing that Requires an Interior Structural Silicone Seal - Up to 90PSF	**E2-0353**		**3/8"-16 Nut HHMS** Zinc Plated, For Attachment of "J" Anchor	**HM-3800**
	**Interior Glazing Silicone Spacer** For Large Missile Glazing that Requires an Interior Structural Silicone Seal - Above 90PSF	**E2-0222**		**3/8" Flat Washer** Zinc Plated, For Attachment of "J" Anchor	**WW-3800**

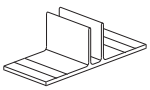
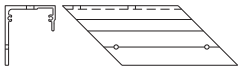
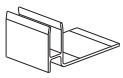
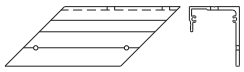
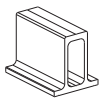
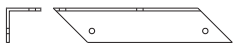
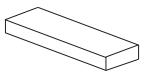
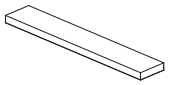
ACCESSORIES (45-55 PSF)

	**3/8”-16 x 1” HHMS** Grade 5 Zinc Plated, For Attachment of “J” Anchor at Jamb	**HM-3816**		**1/2” Flat Washer** Zinc Plated, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**WW-5000**
	**3/8”-16 x 4” HHMS** Grade 5 Zinc Plated, For Attachment of “J” Anchor at Intermediate Vertical	**HM-3864**		**1/2”-13 x 4-1/2” HHMS** Grade 5 Zinc Plated, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**HM-5072**
	**3/8” Lock Washer** Zinc Plated, For Attachment of “J” Anchor	**WS-3800**		**1/2”-13 Nut HHMS** Zinc Plated, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**HM-5000**
	**1/2” Lock Washer** Zinc Plated, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**WS-5000**			

FRAMING MEMBERS (65-90 PSF)

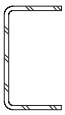
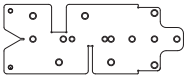
	**Head / Sill / Horizontal** 3” x 5-1/4” For Monolithic Glazing	**E9-3105**		**90° Corner Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3177**
	**Horizontal** 3” x 5-1/4” For Monolithic Glazing	**E9-3106**		**90° Corner Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3175**
	**Mullion** 3” x 5-1/4” For Monolithic Glazing	**E9-3103**		**Face Cover**	**E9-3161**
	**Head / Sill / Horizontal** 3” x 5-1/4” For Insulating Glazing	**E9-3104**		**90° Outside Corner** **Interior Cover** Use with E9-1280	**E9-3165**
	**Intermediate Horizontal** 3” x 5-1/4” For Insulating Glazing	**E9-3102**		**90° Outside Corner** **Interior Cover Base**	**E9-1280**
	**Mullion** 3” x 5-1/4” For Insulating Glazing	**E9-3101**		**90° Outside Corner** **Face Cover** For Monolithic Glazing	**E9-3176**
	Flush Filler Use With E9-3104 and E9-3105	**E9-3162**		**90° Outside Corner** **Face Cover** For Insulating Glazing	**E9-3174**
	**Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3173**		**Pocket Filler** For Monolithic Glazing	**E9-3109**
	**Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3172**		**Pocket Filler** For Insulating Glazing	**E9-3110**
	**Perimeter Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3179**		**1-1/2” x 1-1/2” Angle**	**E9-9303**
	**Perimeter Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3178**		**1/4” Glazing Adaptor**	**E9-3141**

ACCESSORIES (65-90 PSF)

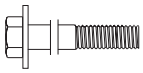
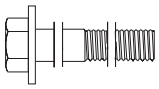
	**Shear Block** Use With E9-3104 & E9-3105	**E1-3001**		**Temporary Pressure Plate** For Insulating Glazing	**E1-3025**
	**"J" Anchor**	**E1-3002**		**Shear Block** For 90° Corner Mullion	**E1-3013**
	**Intermediate Vertical Mullion End Anchor** Requires E1-3006 Anchor Sleeve	**E1-3003**		**"J" Anchor (Right Hand)** For 90° Corner Mullion	**E1-3014**
	**Jamb Mullion End Anchor** Requires E1-3006 Anchor Sleeve	**E1-3004**		**"J" Anchor (Left Hand)** For 90° Corner Mullion	**E1-3015**
	**"T" Anchor** Use at Door Jamb	**E1-3039**		**Shear Clip (Right Hand)** For 90° Corner Mullion	**E1-3016**
	**Mullion Splice Sleeve**	**E1-3005**		**Shear Clip (Left Hand)** For 90° Corner Mullion	**E1-3017**
	**Mullion Anchor Sleeve**	**E1-3006**		**Mullion End Anchor** For 90° Corner Mullion	**E1-3018**
	**Mullion Reinforcement Sleeve**	**E1-3007**		**Setting Block** For Monolithic Glazing	**E2-0623**
	**Face Cover Splice Sleeve**	**E1-3009**		**Setting Block** For Insulating Glazing	**E2-0611**
	**Mullion End Cap** For Monolithic Glazing	**E1-3011**		**Side Block**	**E2-0537**
	**Mullion End Cap** For Insulating Glazing	**E1-3010**		**Joint Plug** For Monolithic Glazing	**E2-0358**
	**Temporary Pressure Plate** For Monolithic Glazing	**E1-3026**		**Joint Plug** For Insulating Glazing	**E2-0355**

***Note:** Exact size of anchors should be determined from loads calculated on each individual curtain wall.

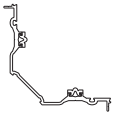
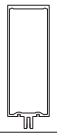
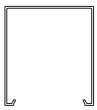
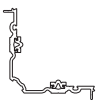
ACCESSORIES (65-90 PSF)

	**Isolator Tape** 3/8" x 1/4" Use with Perimeter Pressure Plate	**E2-0386**		**#10 x 1" FHSMS Type AB** Zinc Plated For Attachment of Monolithic Glazing Adaptor	**FC-1016**
	**Wind Load / Dead Load Anchor Slip Pad**	**E3-0103**		**#12 x 3/4" FHSMS Type AB** Zinc Plated For Attachment of Mullion Splice Sleeve	**FC-1212**
	**Wind Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1204**		**#12 x 1-1/4" FHSMS Type AB** Zinc Plated For Attachment of Horizontal to Shear Block	**FC-1220**
	**Dead Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1205**		**#14 x 5/8" FHSMS Type AB** Zinc Plated For Attachment of Mullion End Cap	**FC-1410**
	**Steel Reinforcing** 2-1/2" x 4-1/2" x 3/16" x 10'	**E1-01751000**		**#10 x 5/8" PHSMS Type AB** Zinc Plated For Attachment of E1-3006 Anchor Sleeve	**PC-1010**
	**Steel Reinforcing** 2-1/2" x 4-1/2" x 3/16" x 20'	**E1-01752000**		**1/4"-20 x 5/8" HWHTCS Type F,** Zinc Plated For Attachment of Shear Block to Vertical	**HF-2510-W1**
	**Interior/Exterior Glazing Gasket**	**E2-0379**		**1/4"-20 x 1" HWHTCS Type F** Zinc Plated, For Attachment of Shear Block to Vertical with Steel Reinforcing	**HF-2516-W1**
	**Interior/Exterior Glazing Gasket** For 1/4" Monolithic and 1" Insulating Glass	**E2-0380**		**1/4"-20 x 1" HWHMS** Zinc Plated, For Attachment of Pressure Plate to Mullion at Interior Corner	**HM-2516-W3**
	**Interior Glazing Silicone Spacer** For Large Missile Glazing that Requires an Interior Structural Silicone Seal - Up to 90PSF	**E2-0353**		**1/4"-20 x 1-1/4" HWHMS** Zinc Plated, For Attachment of Pressure Plate to Mullion	**HD-2520-W3**
	**Interior Glazing Silicone Spacer** For Large Missile Glazing that Requires an Interior Structural Silicone Seal - Above 90PSF	**E2-0222**		**3/8"-16 Nut HHMS** Zinc Plated, For Attachment of "J" Anchor	**HM-3800**
	**Drill Fixture**	**H-7213**		**3/8" Flat Washer** Zinc Plated, For Attachment of "J" Anchor	**WW-3800**
	**#8-32 x 1/2" FHTCS Type F** Zinc Plated, For Attachment of Face Cover Splice Sleeve	**FF-0808**		**3/8" Lock Washer** Zinc Plated, For Attachment of "J" Anchor	**WS-3800**

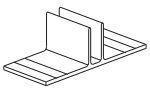
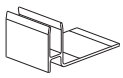
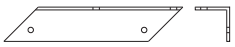
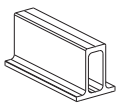
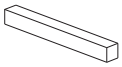
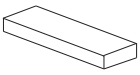
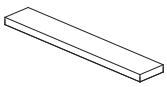
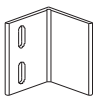
ACCESSORIES (65-90 PSF)

	**3/8”-16 x 1” HHMS** Grade 5 Zinc Plated, For Attachment of “J” Anchor at Jamb	**HM-3816**		**1/2” Flat Washer** Zinc Plated, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**WW-5000**
	**3/8”-16 x 4” HHMS** Grade 5 Zinc Plated, For Attachment of “J” Anchor at Intermediate Vertical	**HM-3864**		**1/2” Lock Washer** Zinc Plated, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**WS-5000**
	**1/2”-13 Nut HHMS** Zinc Plated, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**HM-5000**		**1/2”-13 x 4-1/2” HHMS** Grade 5 Zinc Plated, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**HM-5072**

FRAMING MEMBERS (90-130 PSF)

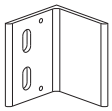
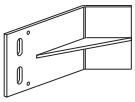
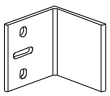
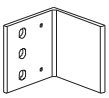
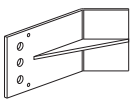
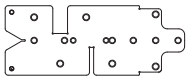
	**Head / Sill / Horizontal** 3” x 8” For Monolithic Glazing	**E9-3189**		**90° Corner Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3175**
	**Horizontal** 3” x 8” For Monolithic Glazing	**E9-3190**		**Face Cover**	**E9-3161**
	**Mullion** 3” x 8” For Monolithic Glazing	**E9-3182**		**90° Outside Corner Interior Cover** Use with E9-1280	**E9-3160**
	**Head / Sill / Horizontal** 3” x 8” For Insulating Glazing	**E9-3187**		**Interior Cover** Use with E9-3185 & E9-3190	**E9-3186**
	**Intermediate Horizontal** 3” x 8” For Insulating Glazing	**E9-3185**		**90° Outside Corner Interior Cover Base**	**E9-1280**
	**Mullion** 3” x 8” For Insulating Glazing	**E9-3183**		**90° Outside Corner Face Cover** For Monolithic Glazing	**E9-3176**
	Flush Filler	**E9-3188**		**90° Outside Corner Face Cover** For Insulating Glazing	**E9-3174**
	**Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3173**		**Pocket Filler** For Monolithic Glazing	**E9-3109**
	**Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3172**		**Pocket Filler** For Insulating Glazing	**E9-3110**
	**Perimeter Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3179**		**1-1/2” x 1-1/2” Angle**	**E9-9303**
	**Perimeter Pressure Plate** For Insulating Glazing Punched 9” o.c.	**AS-3178**		**1/4” Glazing Adaptor**	**E9-3141**
	**90° Corner Pressure Plate** For Monolithic Glazing Punched 9” o.c.	**AS-3177**			

ACCESSORIES (90-130 PSF)

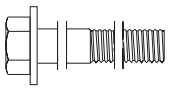
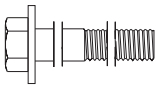
	**Shear Block** Use With E9-3190 & E9-3185	**E1-3032**		**Temporary Pressure Plate** For Insulating Glazing	**E1-3025**
	**Shear Block** Use With E9-3189 & E9-3187	**E1-3040**		**Shear Block** For 90° Corner Mullion	**E1-3027**
	**Intermediate Vertical Mullion End Anchor** Requires E1-3033 Anchor Sleeve	**E1-3034**		**Shear Clip (Right Hand)** For 90° Corner Mullion	**E1-3028**
	**Jamb Mullion End Anchor** Requires E1-3033 Anchor Sleeve	**E1-3035**		**Shear Clip (Left Hand)** For 90° Corner Mullion	**E1-3029**
	**“T” Anchor** Use at Door Jamb	**E1-3038**		**Setting Block** For Monolithic Glazing	**E2-0623**
	**Mullion Splice Sleeve**	**E1-3037**		**Setting Block** For Insulating Glazing	**E2-0611**
	**Mullion Anchor Sleeve**	**E1-3033**		**Side Block**	**E2-0537**
	**Mullion Reinforcement Sleeve**	**E1-3030**		**Joint Plug** For Monolithic Glazing	**E2-0358**
	**Face Cover Splice Sleeve**	**E1-3009**		**Joint Plug** For Insulating Glazing	**E2-0355**
	**Mullion End Cap** For Monolithic Glazing	**E1-3011**		**Isolator Tape** 3/8” x 1/4” Use with Perimeter Pressure Plate	**E2-0386**
	**Mullion End Cap** For Insulating Glazing	**E1-3010**		**Wind Load / Dead Load Anchor Slip Pad**	**E3-0103**
	**Temporary Pressure Plate** For Monolithic Glazing	**E1-3026**		**Wind Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1204**

***Note:** Exact size of anchors should be determined from loads calculated on each individual curtain wall.

ACCESSORIES (90-130 PSF)

	**HD Wind Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1280**		**#10 x 1" FHSMS Type AB** Zinc Plated Steel, For Attachment of Monolithic Glazing Adaptor	**FC-1016**
	**HD Corner Wind Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1283**		**#12 x 3/4" FHSMS Type AB** Zinc Plated Steel, For Attachment of Mullion Splice Sleeve	**FC-1212**
	**Dead Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1205**		**#12 x 1-1/4" FHSMS Type AB** Zinc Plated Steel, For Attachment of Horizontal to Shear Block	**FC-1220**
	**HD Dead Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1281**		**#14 x 5/8" FHSMS Type AB** Zinc Plated Steel, For Attachment of Mullion End Cap	**FC-1410**
	**HD Corner Dead Load Anchor*** Refer to Shop Drawings for Anchor Dimensions	**E1-1282**		**#10 x 5/8" PHSMS Type AB** Zinc Plated Steel, For Attachment of E1-3006 Anchor Sleeve	**PC-1010**
	**Steel Reinforcing** 2-1/2" x 7-1/4" x 3/16" x 10'	**E1-30311000**		**1/4"-20 x 5/8" HWHTCS Type F,** Zinc Plated Steel For Attachment of Shear Block to Vertical	**HF-2510-W1**
	**Interior/Exterior Glazing Gasket**	**E2-0379**		**1/4"-20 x 1" HWHTCS Type F** Zinc Plated Steel, For Attachment of Shear Block to Vertical with Steel Reinforcing	**HF-2516-W1**
	**Interior/Exterior Glazing Gasket** For 1/4" Monolithic and 1" Insulating Glass	**E2-0380**		**1/4"-20 x 1" HWHMS** Zinc Plated Steel, For Attachment of Pressure Plate to Mullion at Interior Corner	**HM-2516-W3**
	**Interior Glazing Silicone Spacer** For Large Missile Glazing that Requires an Interior Structural Silicone Seal - Up to 90PSF	**E2-0353**		**1/4"-20 x 1-1/4" HWHMS** Zinc Plated Steel, For Attachment of Pressure Plate to Mullion	**HD-2520-W3**
	**Interior Glazing Silicone Spacer** For Large Missile Glazing that Requires an Interior Structural Silicone Seal - Above 90PSF	**E2-0222**		**1/2"-13 Nut HHMS** Zinc Plated Steel, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**HM-5000**
	**Drill Fixture**	**H-7213**		**1/2" Flat Washer** Zinc Plated Steel, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**WW-5000**
	**#8-32 x 1/2" FHTCS Type F** Zinc Plated Steel, For Attachment of Face Cover Splice Sleeve	**FF-0808**		**1/2" Lock Washer** Zinc Plated Steel, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**WS-5000**

ACCESSORIES (90-130 PSF)

	**5/8”-11 Nut HHMS** Zinc Plated Steel, For Attachment of Heavy Duty Anchors	**HM-5800**		**5/8” Lock Washer** Zinc Plated Steel, For Attachment of Heavy Duty Anchors	**WS-5800**
	**5/8” Flat Washer** Zinc Plated Steel, For Attachment of Heavy Duty Anchors	**WW-5800**		**5/8”-11 x 5” HHMS** Grade 5 Zinc Plated Steel, For Attachment of Heavy Duty Anchors	**HM-5880**
	**1/2”-13 x 4-1/2” HHMS** Grade 5 Zinc Plated Steel, For Attachment of Mid-Anchors (Wind Load / Dead Load)	**HM-5072**			

FOR FLORIDA PRODUCT APPROVAL APPLICATIONS

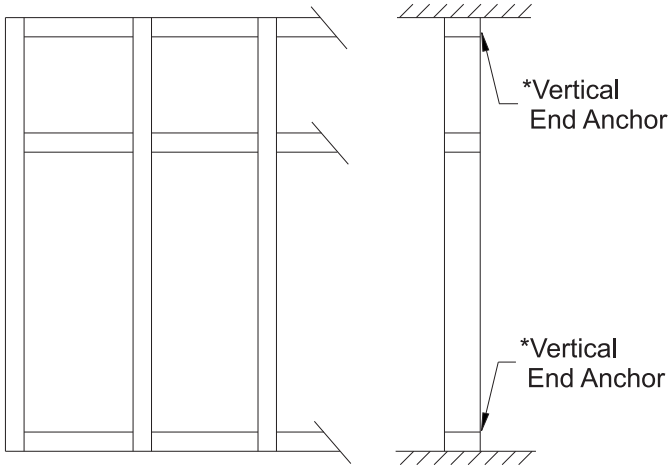
*Anchor	Supplier	Part No.	Qty.	Diameter	Edge Distance	Embedment
“F” Anchor	POWERS	WEDGE BOLT	2	1/2”	6”	4”
“F” Anchor	HILTI	KWIK BOLT III 256693	2	3/8”	7 1/2”	2 1/2”
		SUPER ROD ADHESIVE 68658		1/2”	6 3/4”	4 1/4”
“T” Anchor	POWERS	WEDGE BOLT	2	1/2”	6”	4”
“T” Anchor	POWERS	WEDGE BOLT	2	1/2”	6”	4”
“J” Anchor	POWERS	WEDGE BOLT	2	1/2”	6”	4”
“J” Anchor	HILTI	KWIK BOLT III 256693	2	3/8”	7 1/2”	2 1/2”
		SUPER ROD ADHESIVE 68658		1/2”	6 3/4”	4 1/4”
“J” Anchor	POWERS	WEDGE BOLT	2	1/2”	6”	4”
“J” Anchor	POWERS	WEDGE BOLT	2	1/2”	6”	4”
“J” Anchor	POWERS	WEDGE BOLT	2	1/2”	6”	4”

***Note:** Anchor fasteners are not furnished by YKK AP.
All anchors are assumed in 3,000 PSI concrete.
Anchor bolt size and location will vary according to engineering calculations.

FRAME FABRICATION

FRAME TYPES / ANCHORING METHODS:

Note: The following is a guideline for types of frames. Refer to the shop drawings or consult YKK AP for exact layout of frames. These installation instructions are to be used in conjunction with approved shop drawings. Consult shop drawings for anchorage of mullions to structure.



SINGLE SPAN

Smaller units may be assembled on the ground and lifted in place.

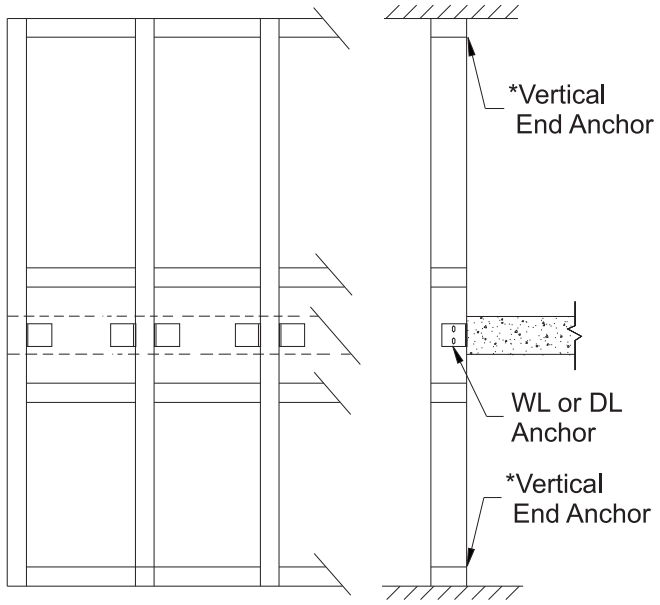
Note: If YKK AP does not prepare the shop drawings for the project, a qualified engineer must approve all anchors and mullions for wind load and dead load.

*Vertical end attachment will be “J”, “F”, and/or “T” mullion end anchors. Refer to shop drawings or consult YKK AP.

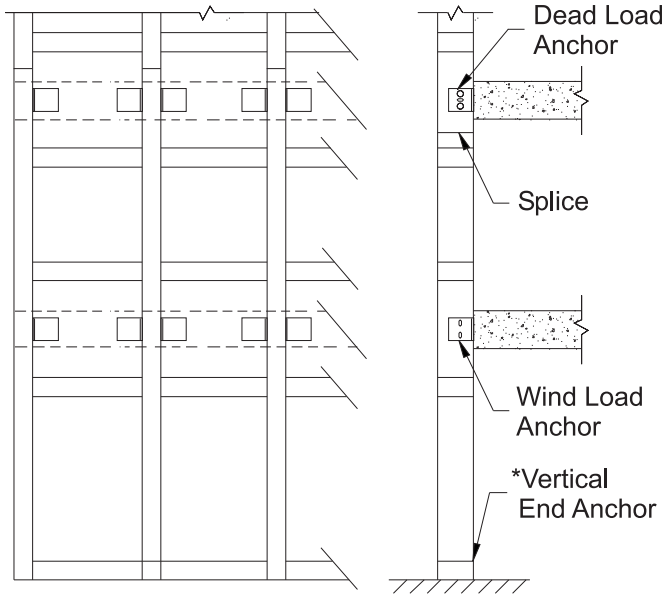
Note: Structure must be capable of resisting all loads imposed by anchor reactions.

Fabrication of YHC 300 OG Curtain Wall varies depending on which anchors are required for a given project.

Larger units require being stick assembled in place.



TWIN SPAN



MULTI-SPAN

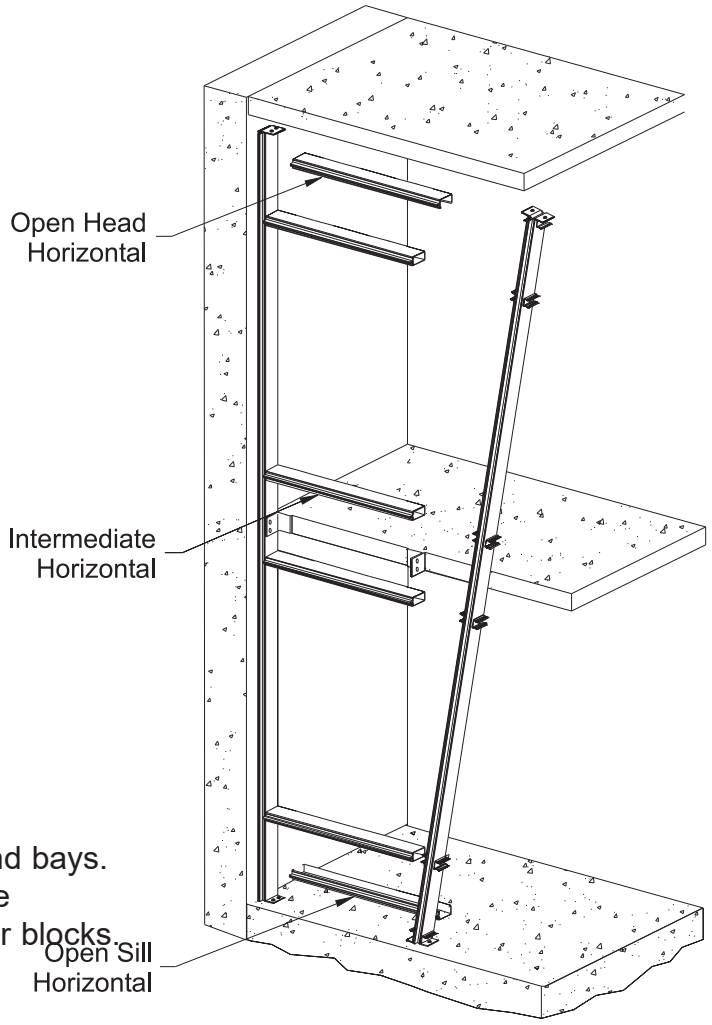
FRAME FABRICATION

Using mullion end anchors:

YHC 300 OG has three possible end anchoring conditions: “J”, “T”, and “F”.

-”J” anchors are used with jambs and intermediate mullions at the sill only.
-”T” anchors are used with intermediate mullions at the head and sill.
-”F” anchors are used with jamb mullions at the head and sill.
-”Door Jamb” anchors are used with mullions at a door jamb and are specificed by the approved shop drawings or P.E. calcs.
-Anchor usage depends on end reaction, stress, and attachment.

Mullions should be pre-assembled with shear blocks, end anchors, and steel or aluminum reinforcing if necessary.



Framing members:

-Open back members are used for all head and sill applications.
-Closed horizontal members are used at all intermediate locations with the exception of end bays.
-Open back members are used for intermediate horizontals at end bays, to slide over the shear blocks.

Note: When using stick built construction, check for plumb, level, and overall frame width every fifth mullion. This helps to avoid the build up of cumulative tolerance errors. Also check that all anchors are secure and firmly attached to the building structure.

FRAME FABRICATION

FABRICATE MULLIONS (45-90 PSF)

Step 1

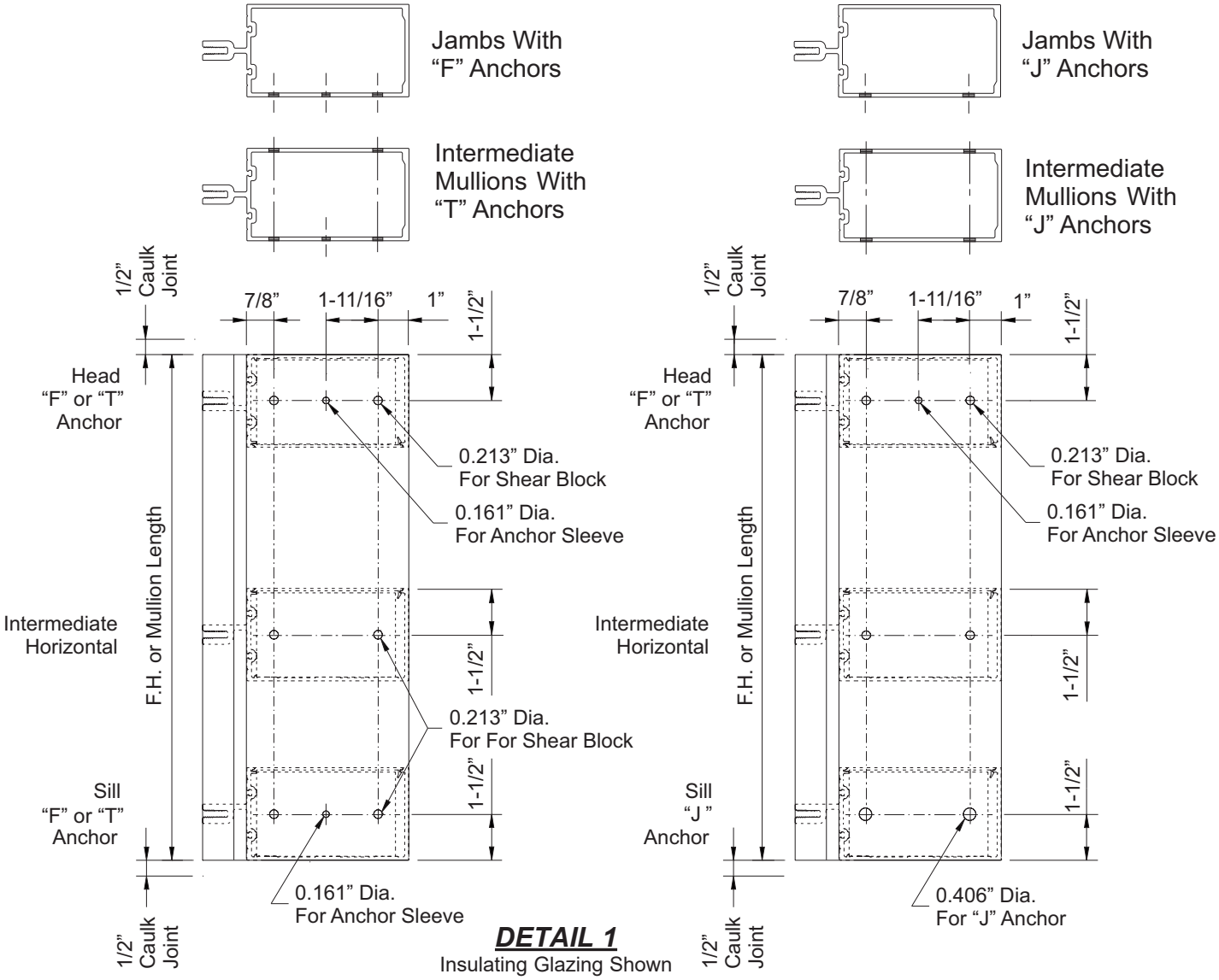
-Cut all mullions to dimensions as shown on shop drawings.
Allow 1/2” for splices and 1/2” caulk joint around the perimeter of the frame.

Step 2

Mullion hole locations for attachment of shear blocks, or “J” anchor are shown below:

-Locate and drill holes in mullions at the locations shown in **Detail 1**.

Note: Mullion hole locations and diameters vary depending on shear block or “J” Anchor usage. For most applications, “J” Anchors are used at the sill only.



DETAIL 1

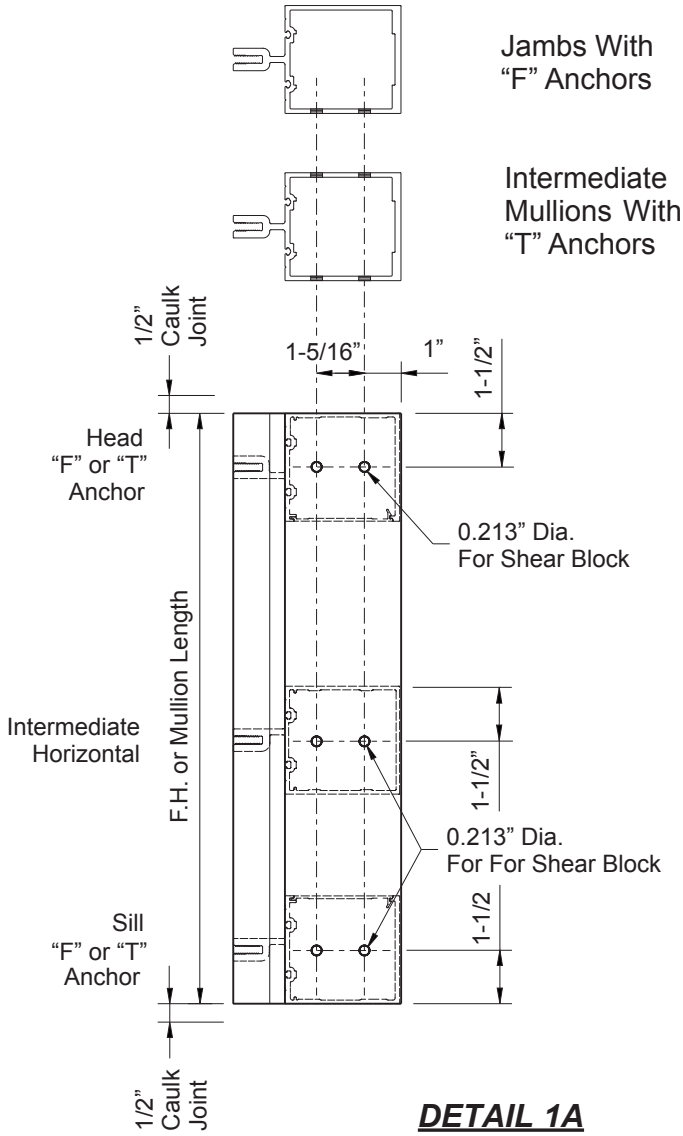
Insulating Glazing Shown
Single Glazing Similar

FRAME FABRICATION

FABRICATE SHALLOW MULLIONS (45-55 PSF ONLY)

-Fabrication for 3” x 3-3/16” mullions is similar to that shown on the previous page except J-anchors, anchor sleeves, and splices are not used.

See **Detail 1A**.



DETAIL 1A
Insulating Glazing Shown
Single Glazing Similar

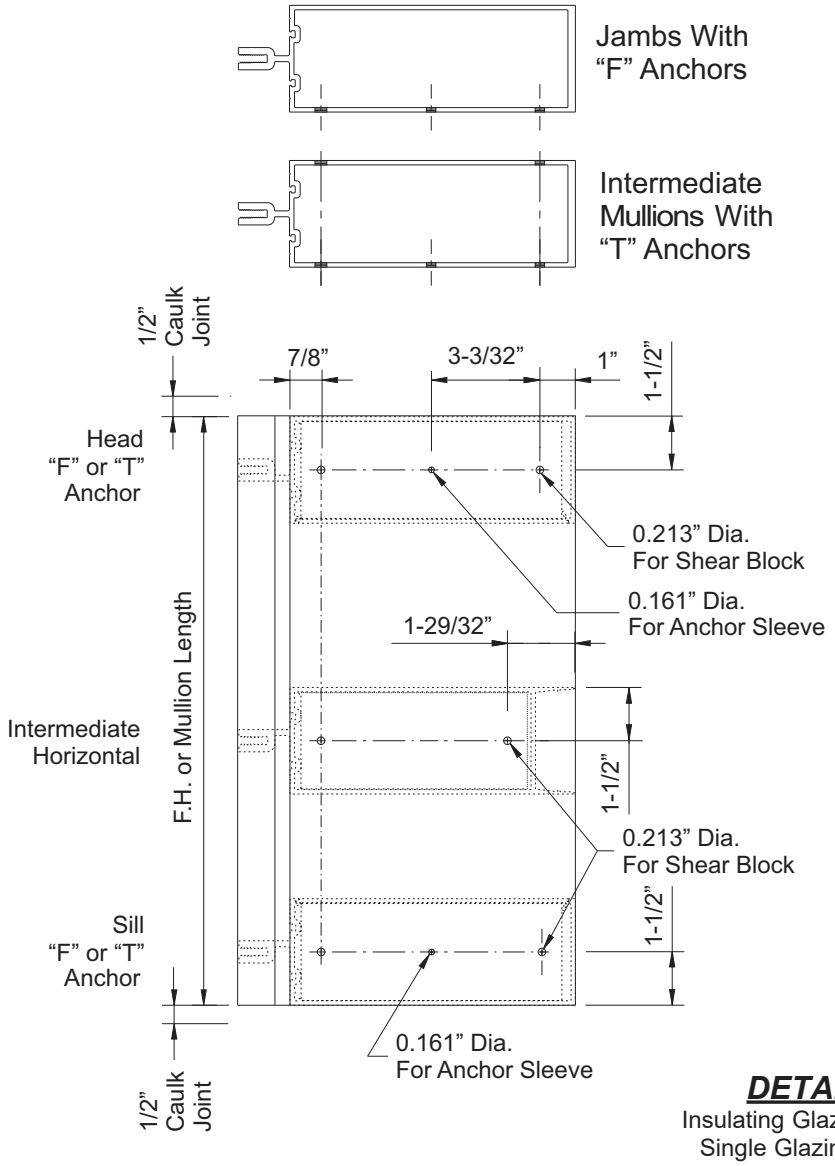
FRAME FABRICATION

FABRICATE MULLIONS (90-130 PSF)

Step 1
-Cut all mullions to dimensions as shown on shop drawings.
Allow 1/2” for splices and 1/2” minimum caulk joint around the perimeter of the frame.

See **Detail 2**.

Note: Mullion hole locations and diameters vary depending on shear block or “J” Anchor usage. “J” Anchors are used at the sill only.



DETAIL 2
Insulating Glazing Shown
Single Glazing Similar

FRAME FABRICATION

FABRICATE DOOR JAMB MULLIONS

Step 1

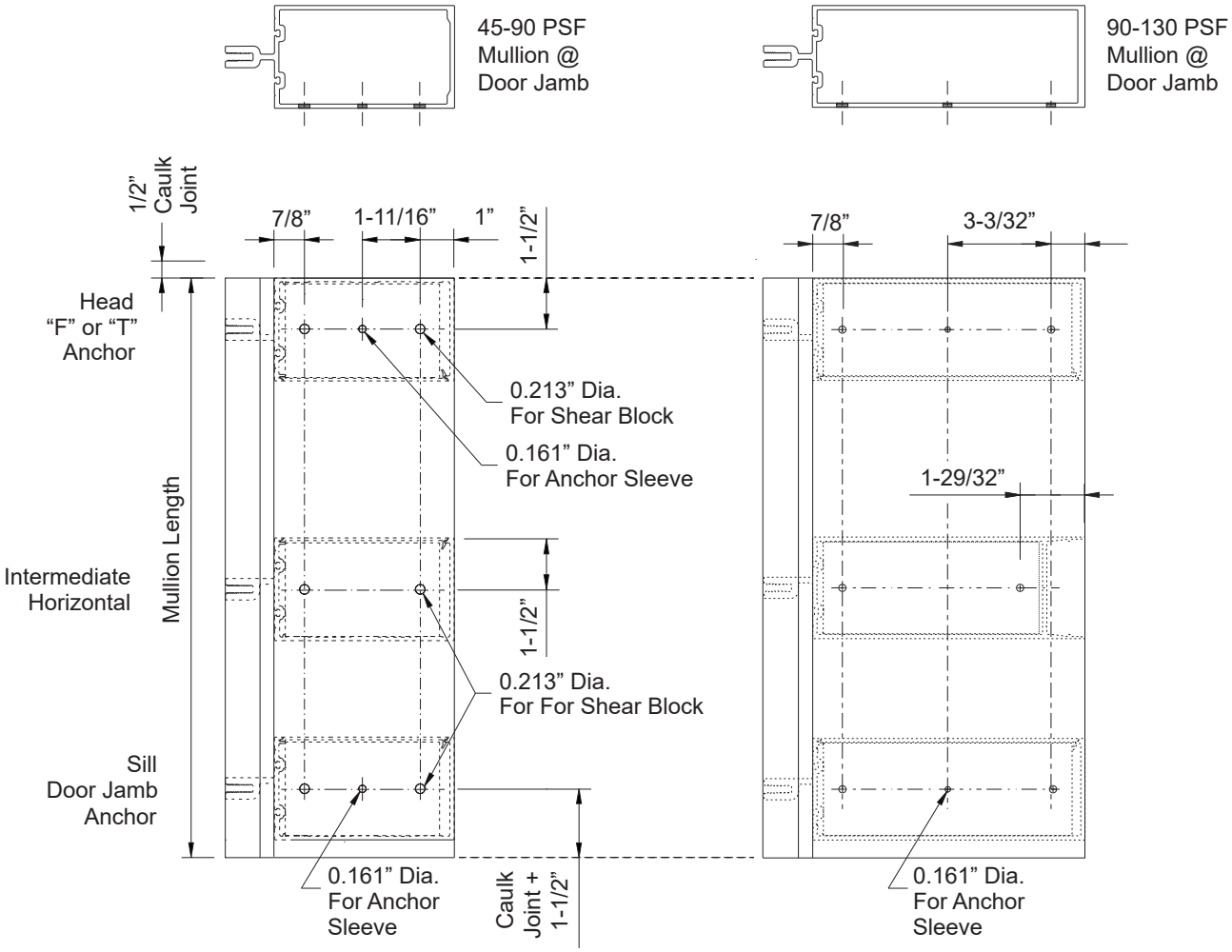
-Cut all mullions to dimensions as shown on shop drawings.
Allow 1/2” for splices and 1/2” caulk joint at the top of the frame.

Step 2

Mullion hole locations for attachment of shear blocks are shown below:

-Locate and drill holes in mullions at the locations shown in **Detail 1**.

Note: Mullion hole locations and diameters vary depending on shear block usage.
“J” Anchors are not used at door jambs.



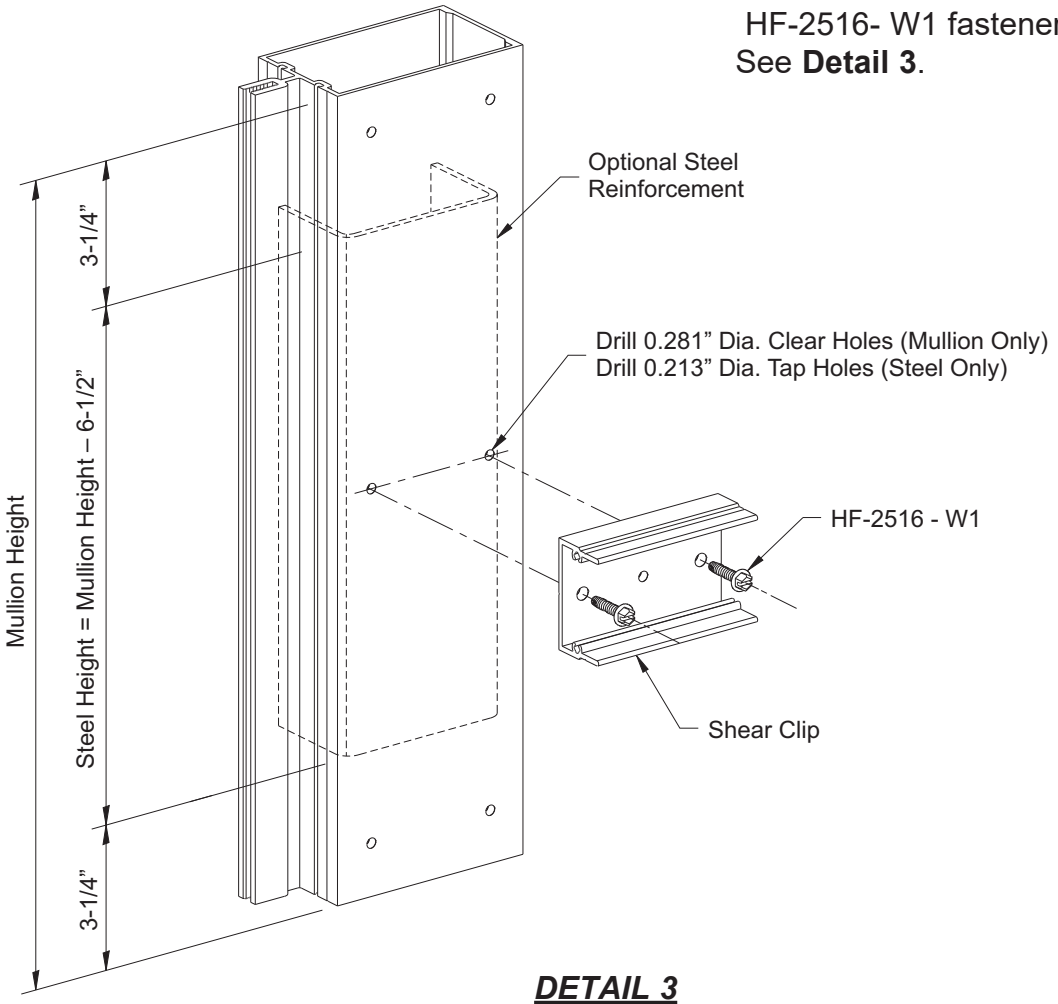
FRAME FABRICATION

STEP 3
USING ALTERNATE REINFORCEMENT, STEEL CHANNEL

-Reference the shop drawings for the location of horizontals. The steel channel is always fastened through the shear clip.
-Drill a 0.281” diameter hole in the vertical mullion being careful to not drill a hole in steel channel.
-Reinforcing must allow clearance for anchor sleeve; locate reinforcing a minimum of 3-1/4” from the end of the mullion.

See **Detail 3**.

-Drill a 0.213” diameter hole in steel channel through the same hole locations using a #3 diameter drill bit.
-Attach shear block using two HF-2516- W1 fasteners per block.
See **Detail 3**.

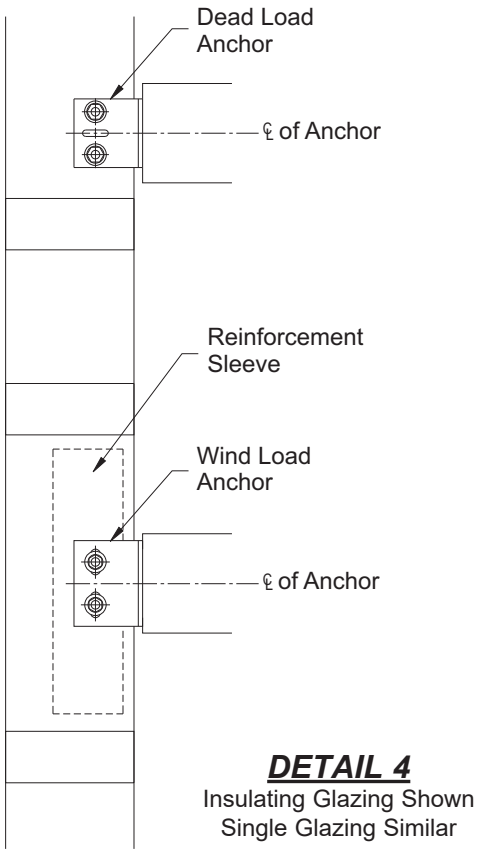


DETAIL 3
Insulating Glazing Shown
Single Glazing Similar

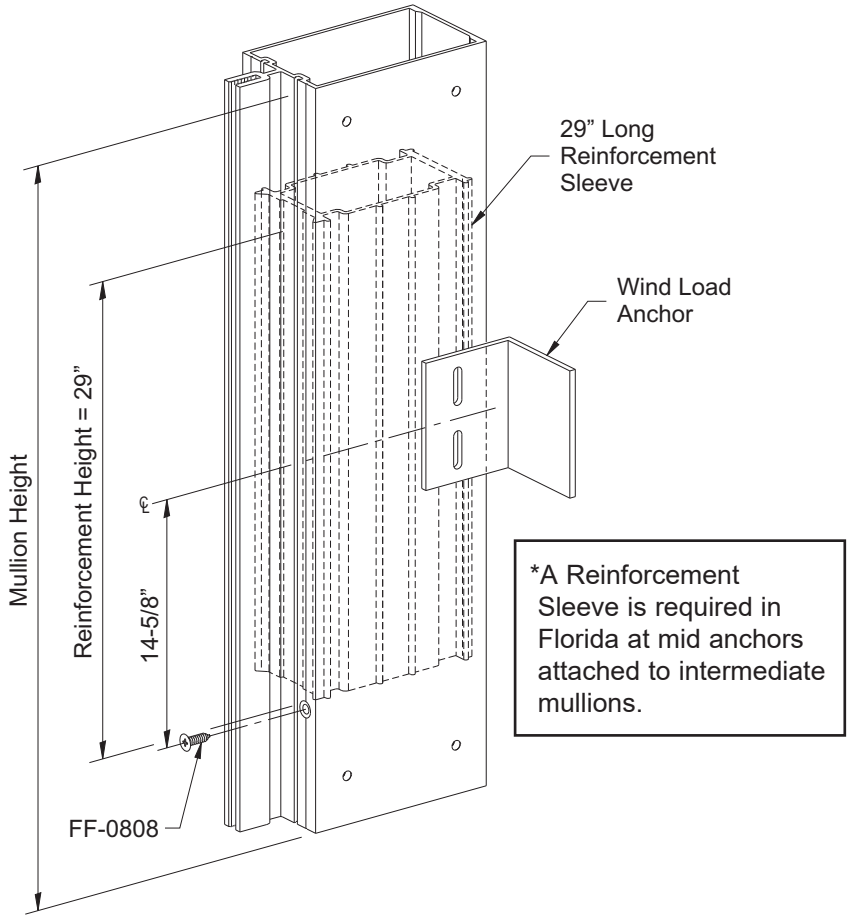
FRAME FABRICATION

STEP 3 (Continued)
USING ALTERNATE REINFORCEMENT, REINFORCEMENT SLEEVE

-If the engineering calculations require the vertical mullions to be reinforced with additional aluminum, a reinforcement sleeve may be used.
-Checking stress levels at point load areas will require different anchors or possibly steel reinforcing.
-A qualified professional engineer should do these calculations.



DETAIL 4
Insulating Glazing Shown
Single Glazing Similar



*A Reinforcement Sleeve is required in Florida at mid anchors attached to intermediate mullions.

-When locating reinforcement sleeve at wind load or dead load anchors see **Detail 4**.
-Reference the shop drawings for the exact location of the centerline of the wind load / dead load anchors.
-From the centerline measure down 14-5/8” along the “V”-groove of the vertical and locate hole for FF-0808 fastener as a stop for reinforcement sleeve.
-Drill a 0.141” diameter hole into the V-Groove of vertical.
-Countersink for #8 flat head screw and install FF-0808 fastener.
See **Detail 4**.

FRAME FABRICATION

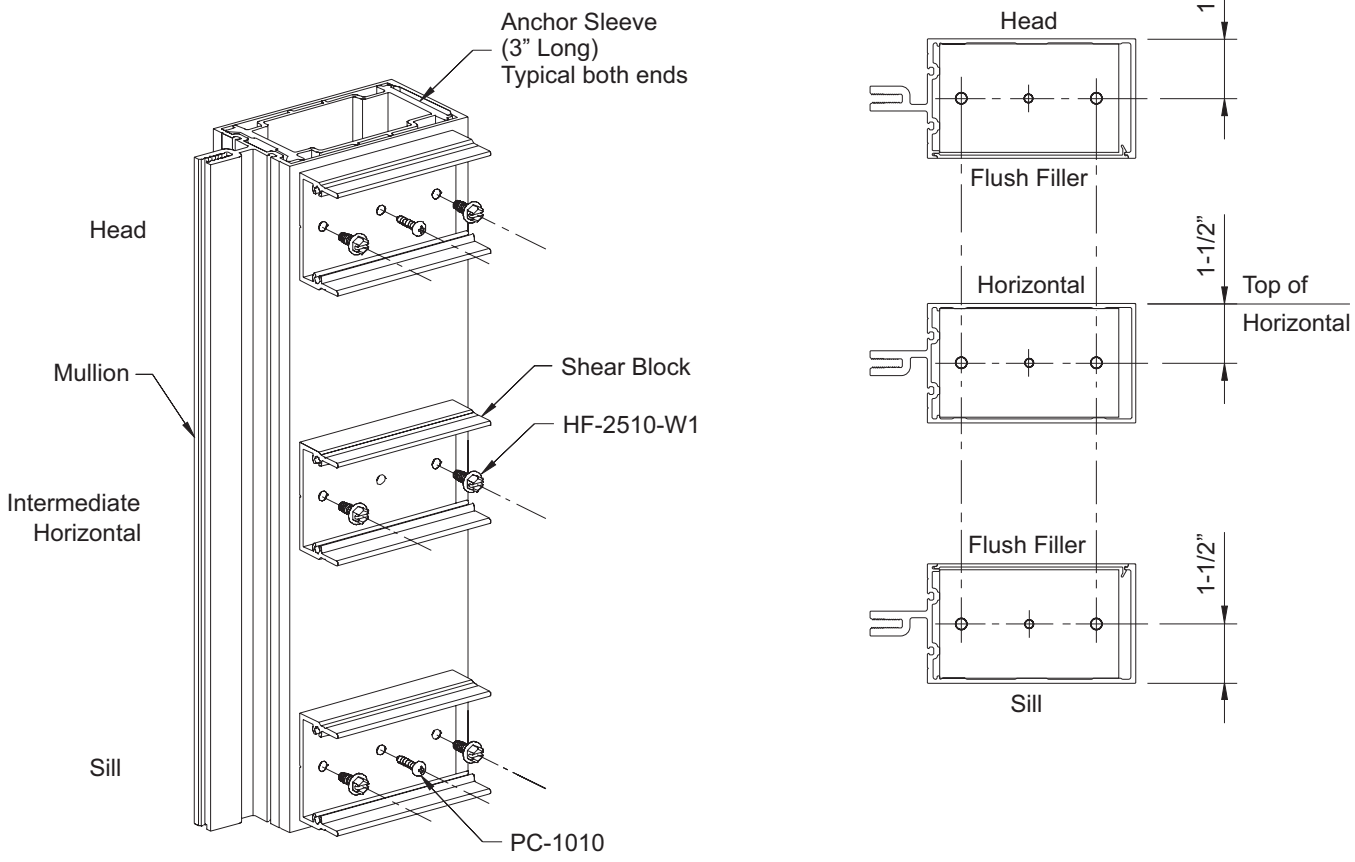
Mullions with “F” or “T” Anchors at Head & Sill

STEP 4
SHEAR BLOCKS FOR HORIZONTALS

Shear blocks are used to attach horizontal members to the mullions.
-Fasten shear blocks to the mullion with two HF-2510-W1 fasteners per clip.

The anchor sleeve centers the “F” and “T” mullion end anchors and must be installed when using “T” and “F” anchors. Anchor sleeves are not required when using a “J” anchor.
-Attach the anchor sleeve to the mullion and shear blocks with one PC-1010 fastener. Anchor sleeves are attached only on one side of the mullion.

See **Detail 5**.



DETAIL 5
Insulating Glazing Shown
Single Glazing Similar

FRAME FABRICATION

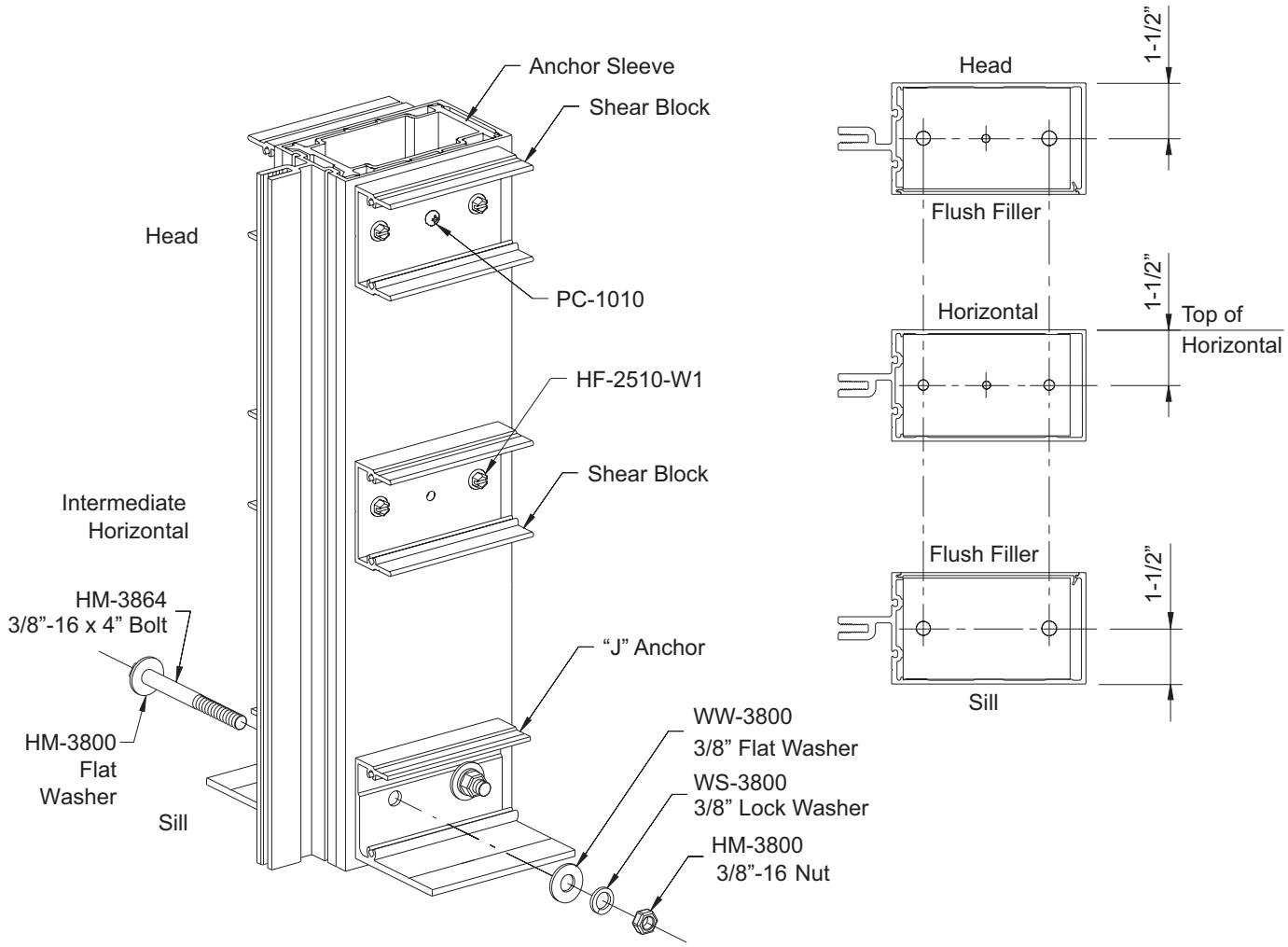
Mullions with “T” Anchor at Head & “J” Anchor at Sill

STEP 5
“J” ANCHORS AT INTERMEDIATE MULLIONS

The “J” anchor is installed without the anchor sleeve and is designed to be attached to intermediate mullions and jambs using two through bolts as shown below.

-Align the “J” anchors and insert the HM-3864 bolts through both anchors and the mullion.
-Install 3/8” flat washers and 3/8” lock washers between the anchor and HM-3800 hex nuts.

See **Detail 6**.



DETAIL 6
Insulating Glazing Shown
Single Glazing Similar

FRAME FABRICATION

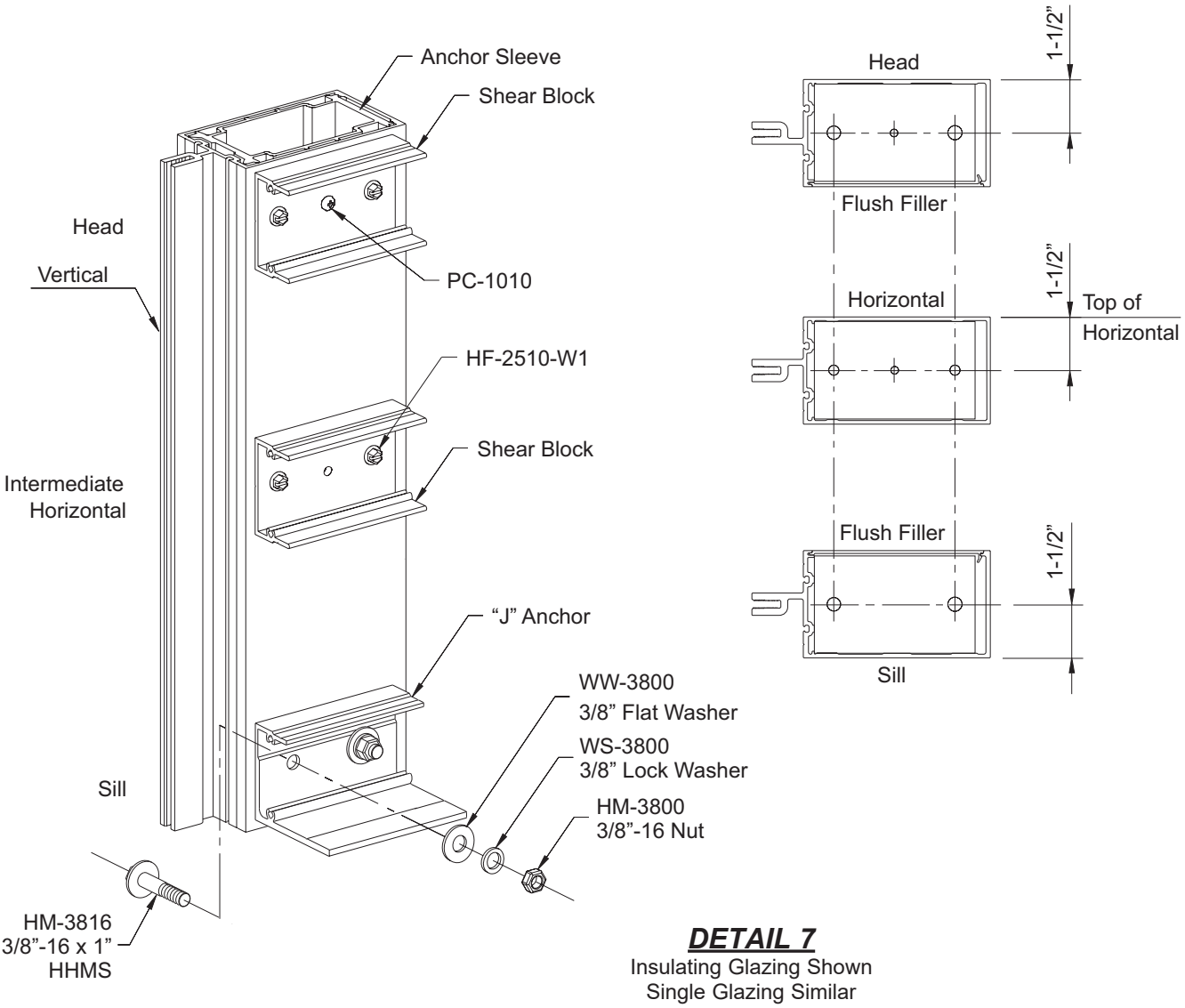
Mullions with “T” Anchor at Head & “J” Anchor at Sill

STEP 5 (Continued)
“J” ANCHORS AT JAMB MULLIONS

A “J” anchor is installed without anchor sleeve, and is designed to be attached to jamb mullions using two 3/8” x 1” bolts as shown below.
Note: “J” anchors are not to be used with 90-130 PSF mullions.

-Align the “J” anchor with the mullion and insert the HM-3816 bolts through the inside of the mullion and out the “J” anchor.
-Install 3/8” flat washers and 3/8” lock washers between the anchor and HM-3800 hex nuts.

See **Detail 7**.



DETAIL 7
Insulating Glazing Shown
Single Glazing Similar

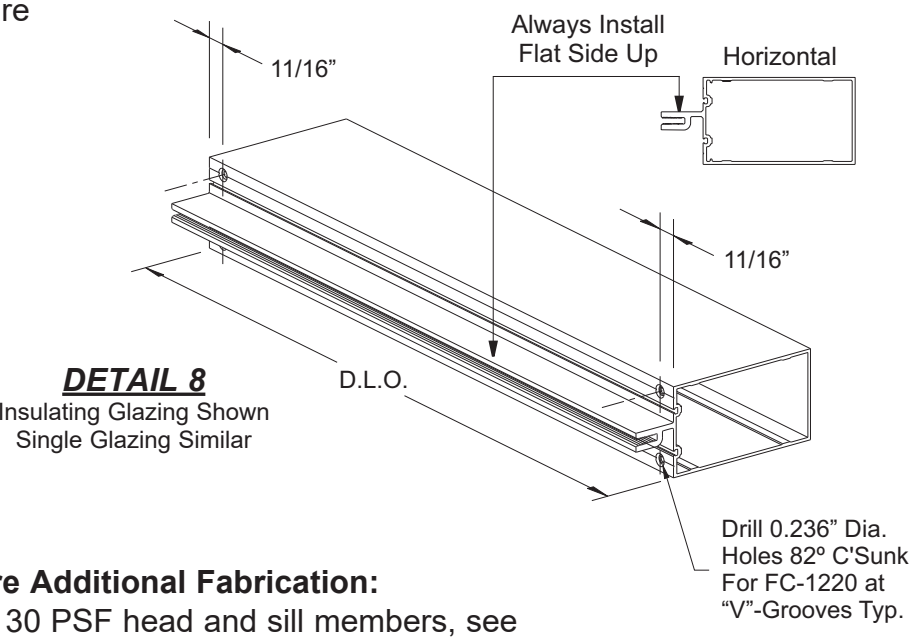
FRAME FABRICATION

STEP 6
FABRICATE HORIZONTAL MEMBERS

-Cut all head, horizontal, sill members, and flush fillers to the daylight opening.
-Drill two 0.236" (#B) dia. holes along the "V"-Grooves above and below the mullion tongue on both ends of the mullion to attach members to the shear bocks.

Note: Closed back horizontals are not to be used at head or sill conditions.

See **Details 8 & 9**.

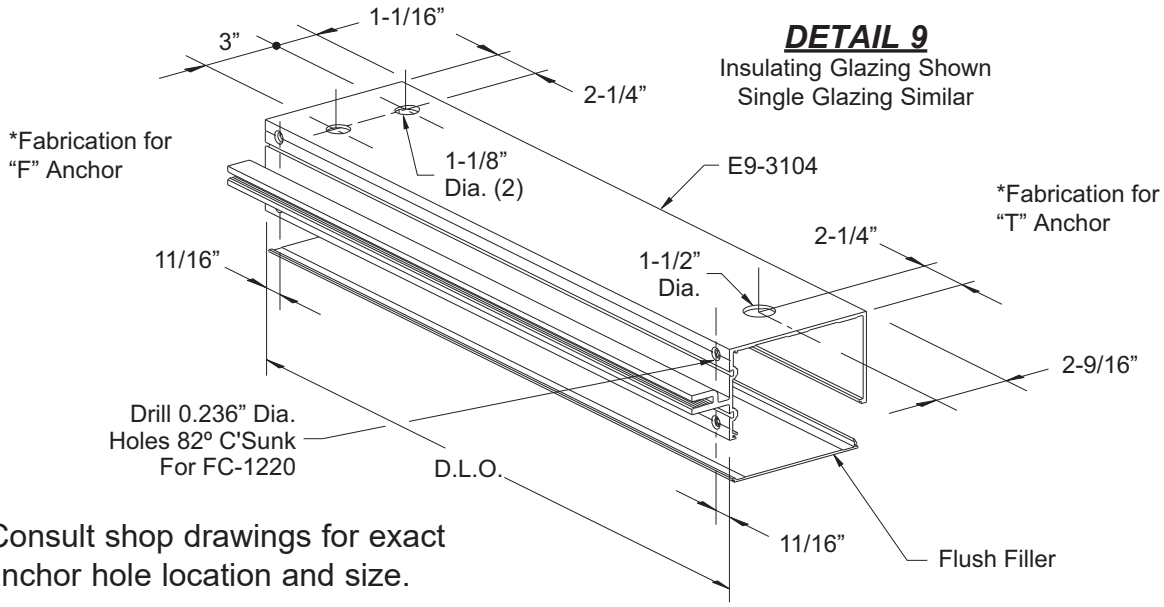


DETAIL 8
Insulating Glazing Shown
Single Glazing Similar

Head and Sill Members Require Additional Fabrication:

Note: For fabrication of 90-130 PSF head and sill members, see **DETAIL 10** on **Page 26**.

-Drill appropriate size clearance holes at each end of the mullion as shown in **Detail 9**, or according to shop drawings or engineering calculations to clear anchor bolts and nuts.



DETAIL 9
Insulating Glazing Shown
Single Glazing Similar

Note: *Consult shop drawings for exact anchor hole location and size.

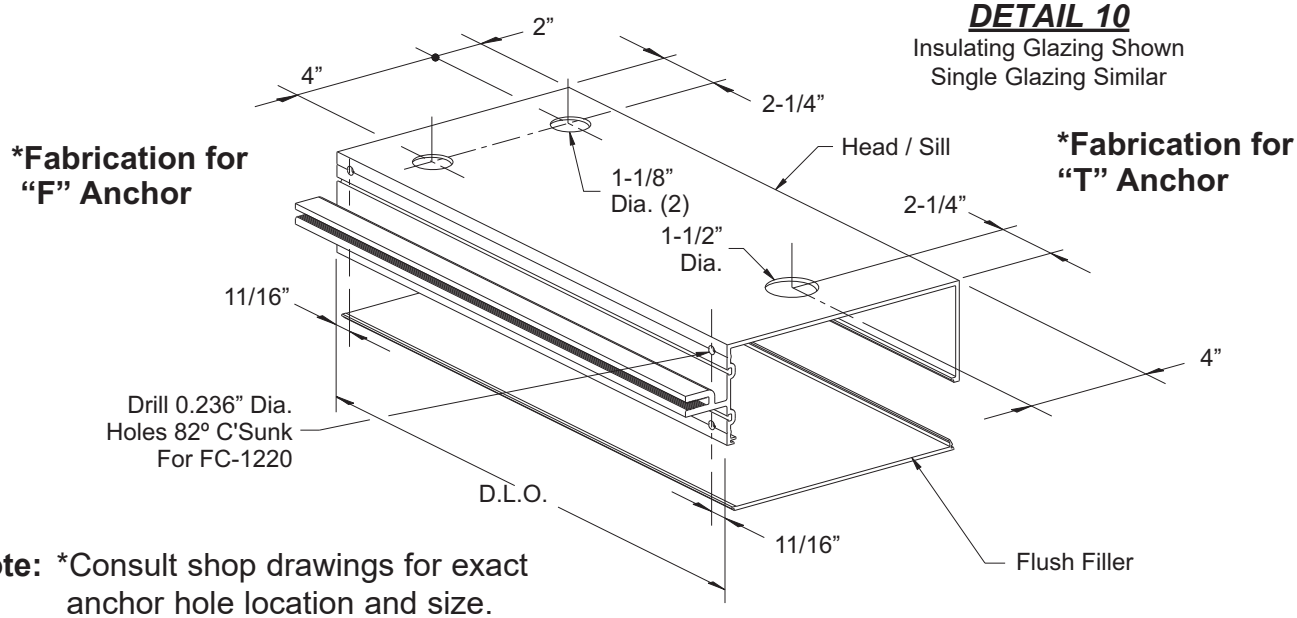
FRAME FABRICATION

STEP 6
FABRICATE HORIZONTAL MEMBERS (Continued)
For 90-130 PSF Mullions

Head and Sill Members Require Additional Fabrication:

-Drill appropriate size clearance holes at each end of the mullion as shown in **Detail 10**, or according to shop drawings or engineering calculations to clear anchor bolts and nuts.

DETAIL 10
Insulating Glazing Shown
Single Glazing Similar



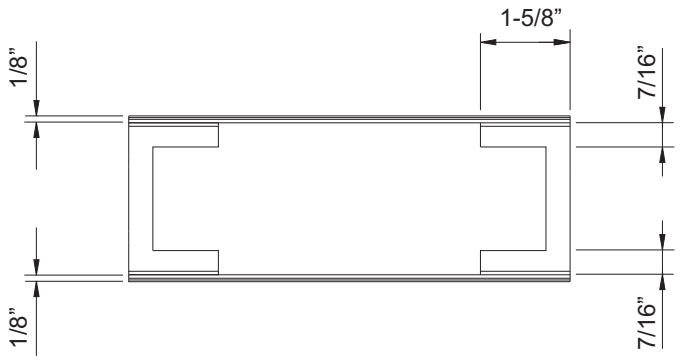
Note: *Consult shop drawings for exact anchor hole location and size.

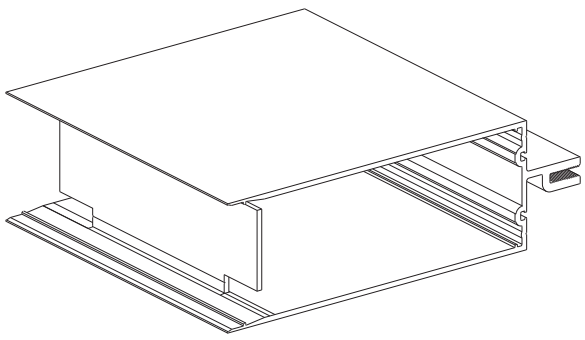
FABRICATE HORIZONTAL END BAYS
For 90-130 PSF Mullions

-When using tubular horizontals at end bays, horizontals must slide in from the exterior.
-In order to clear the shear blocks on the verticals, notch the rear faceof the horizontal at both ends as shown below.

See **Detail 11**.

DETAIL 11
Insulating Glazing Shown
Single Glazing Similar

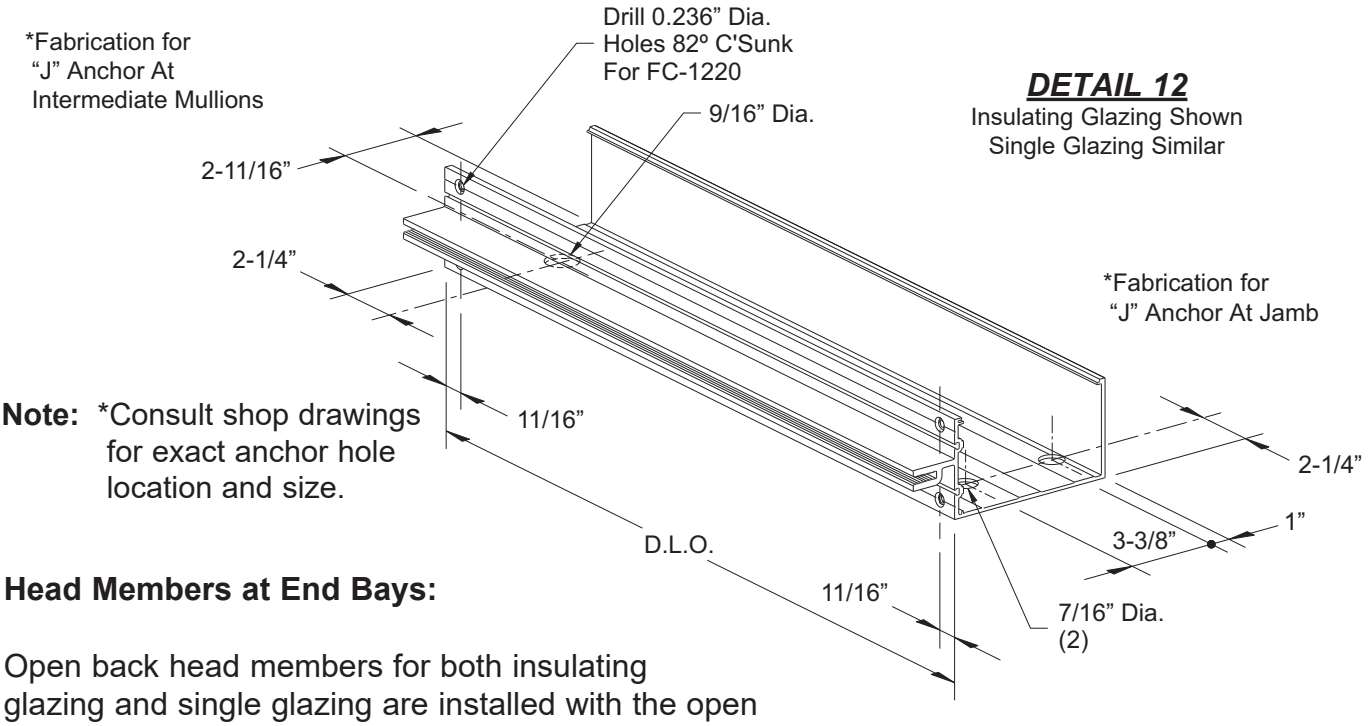




FRAME FABRICATION

STEP 6 (Continued)
FABRICATE HORIZONTAL MEMBERS

-When using “J” anchors, drill appropriate size clearance holes at each end of the sill member as shown in **Detail 12**, or according to shop drawings or engineering calculations to clear anchor bolts.



DETAIL 12
Insulating Glazing Shown
Single Glazing Similar

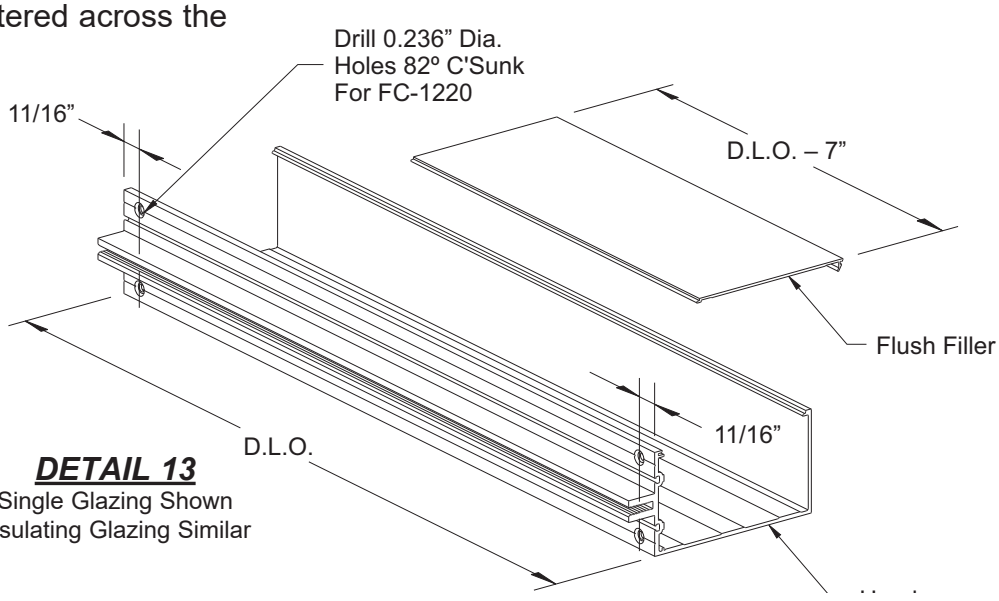
Note: *Consult shop drawings for exact anchor hole location and size.

Head Members at End Bays:

Open back head members for both insulating glazing and single glazing are installed with the open side facing the structure at end bays to clear the anchor bolts:

-Cut the flush filler to Daylight Opening minus(–) 7”.
-Snap in the flush filler centered across the width of the mullion.

See **Detail 13**.



DETAIL 13
Single Glazing Shown
Insulating Glazing Similar

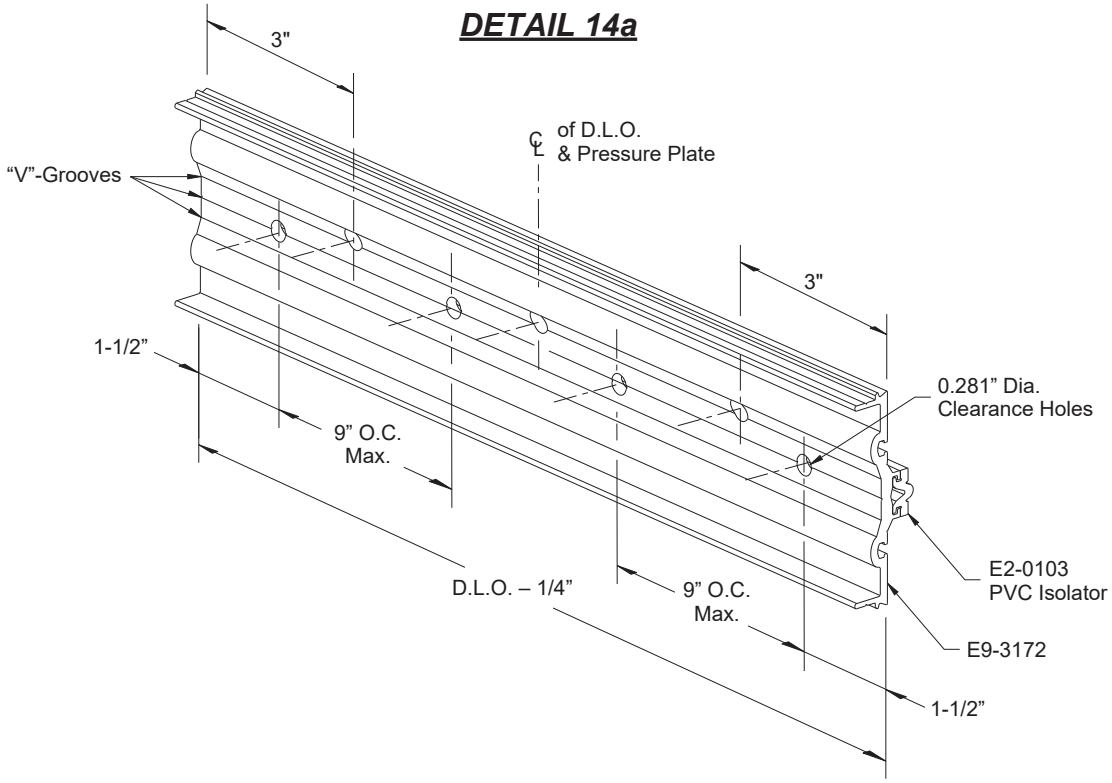
FRAME FABRICATION

STEP 7
FABRICATE HEAD, SILL, AND HORIZONTAL PRESSURE PLATES

-Cut horizontal pressure plates to the daylight opening between verticals minus(–) 1/4”.
-Pressure plate stock lengths have 0.281” dia. holes factory punched every 9”.
After cutting, drill additional holes if required to ensure that end holes are 1-1/2” from each end.
-Drill two 0.313” (5/16”) diameter weep holes 3” from each end and one at the centerline of the pressure plate.

See **Detail 14a for Horizontal Pressure Plate Fabrication**.
See **Details 14b on Page 29 for Head and Sill Perimeter Pressure Plate Fabrication**.

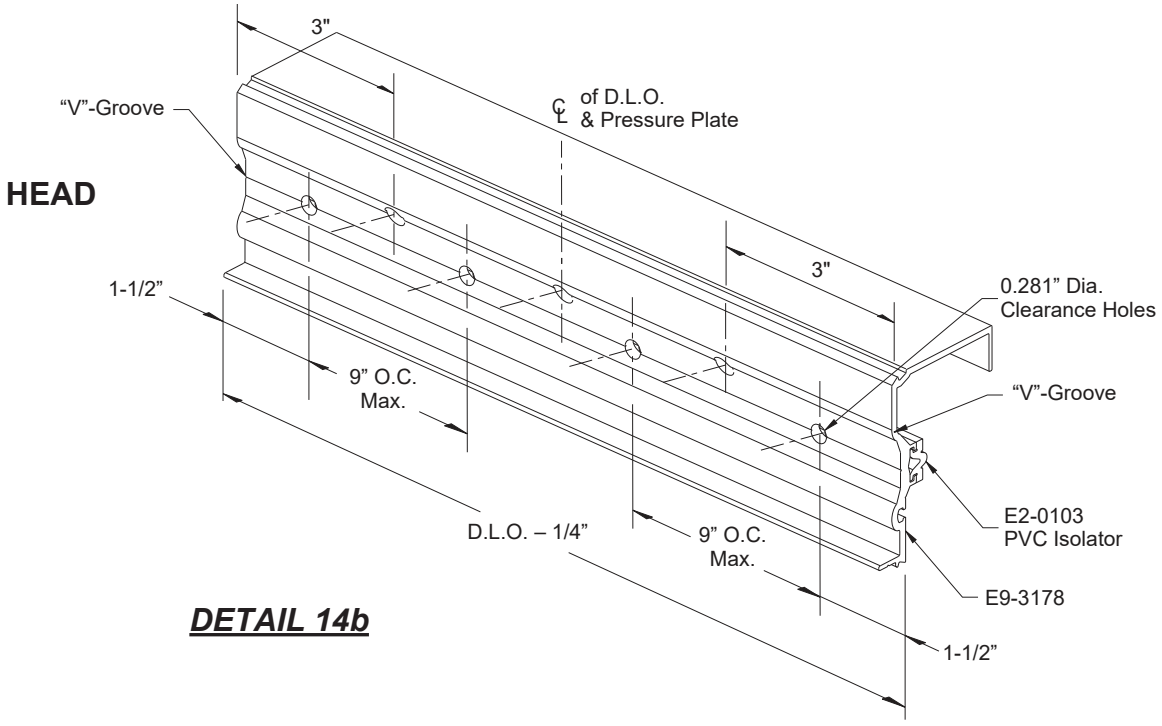
DETAIL 14a



FRAME FABRICATION

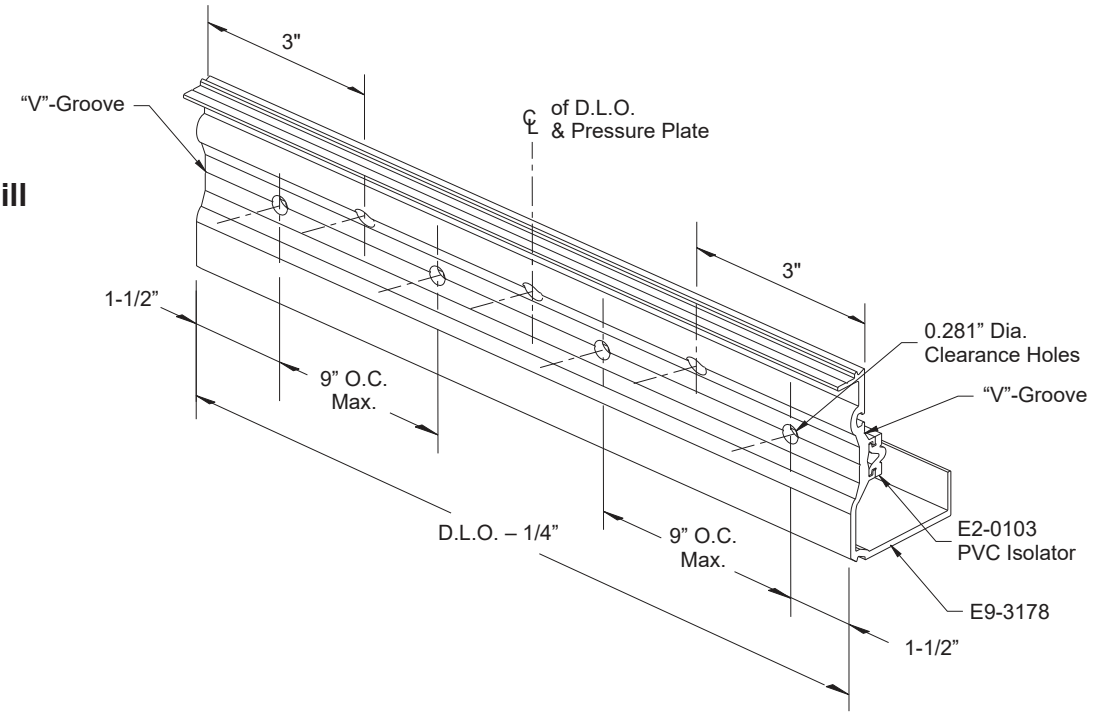
STEP 7 (CONTINUED)
FABRICATE HEAD, SILL, AND HORIZONTAL PRESSURE PLATES

HEAD



DETAIL 14b

Sill



FRAME FABRICATION

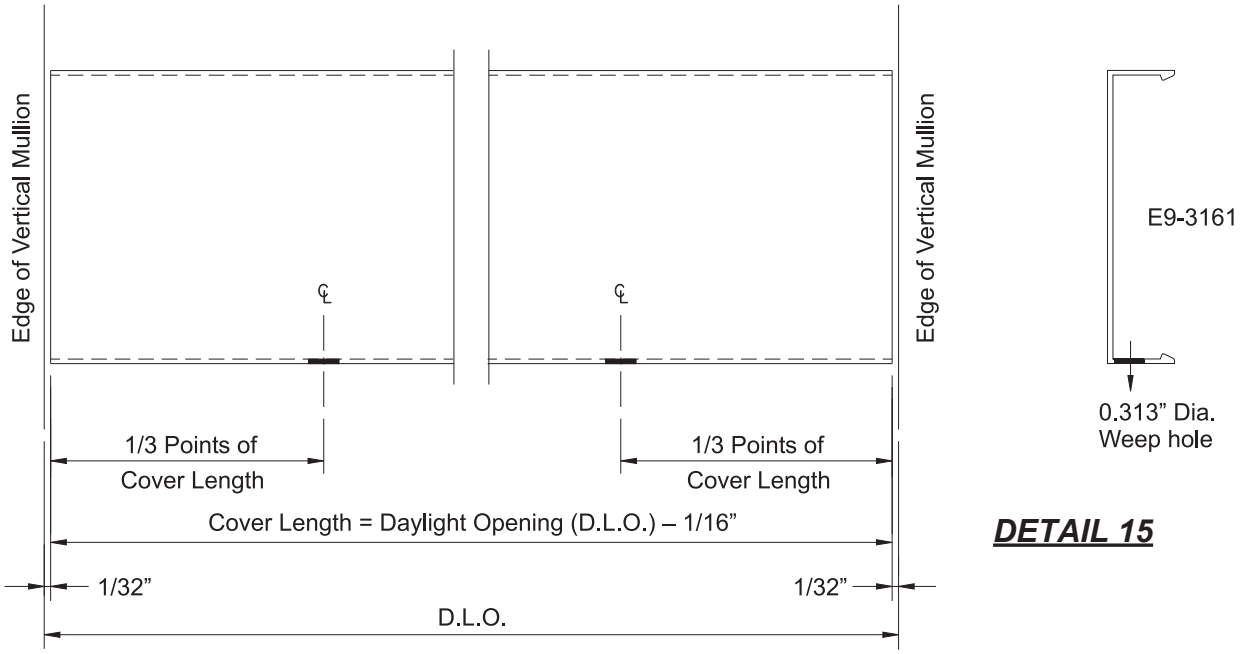
STEP 8
FABRICATE VERTICAL PRESSURE PLATES

-Cut vertical and jamb pressure plates to the same length as the mullions unless mullions are spliced.
-If mullions are spliced, cut pressure plates to accommodate for 1/2” expansion joint as shown in **Detail 17** on **Page-32**.
-Drill additional attachment holes if required to ensure that end holes are 1-1/2” from each end.

STEP 9
FABRICATE HORIZONTAL FACE COVERS

-Cut horizontal face covers, E9-3161, to the daylight opening between verticals minus(–) 1/16”.
-Drill two 0.313” (5/16”) diameter weep holes at 1/3 points of cover as shown.

See **Detail 15**.



DETAIL 15

STEP 10
FABRICATE VERTICAL FACE COVERS

-Cut vertical face covers to the same length as the mullions unless the mullions are spliced.
-If mullions are spliced, cut vertical covers to accommodate for the 1/2” expansion joint as shown in **Detail 17** on **Page-32**.

FRAME FABRICATION

STEP 11
FABRICATE MULLIONS FOR SPLICES

Splice locator screw:

-Measure down 2-5/8” on the side of the mullion and mark the hole location.
-Drill a 0.141” diameter (#28 drill bit) diameter hole and countersink for a #8 flat head fastener for the splice locator screw.

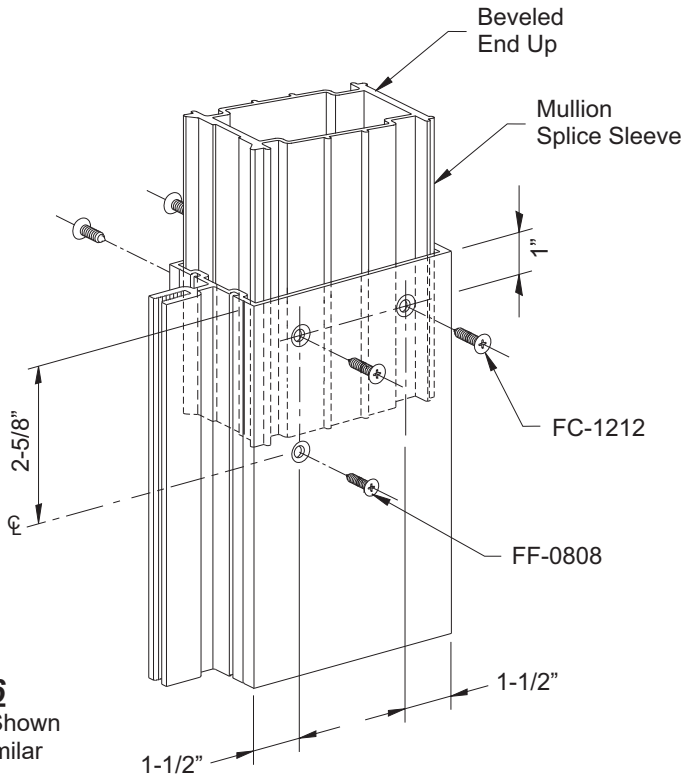
Splice sleeve attachment fasteners:

-Measure down from the top of the mullion 1” on both sides and draw a line parallel with the top of the mullion.
-Measure in from both, the front and the back of the mullion,1-1/2” and mark the hole locations on the previously drawn lines.
-Drill a 0.236” diameter (#B drill bit) diameter hole at each hole location and countersink for a #12 flat head fastener.

Install splice sleeve beveled end up:

-Install one (1) FF-0808 fastener into the side of the mullion to properly locate the splice.
-Carefully slide the splice sleeve down into the end of the mullion with the beveled end up (the beveled end will ease the stacking of the next mullion).
-Match drill 0.189” diameter (#12 drill bit) holes in the splice sleeve through the holes previously drilled in the mullion for the splice sleeve attachment fasteners.
-Attach the splice sleeve with two FC-1212 fasteners on each side of the mullion.

See **Detail 16.**



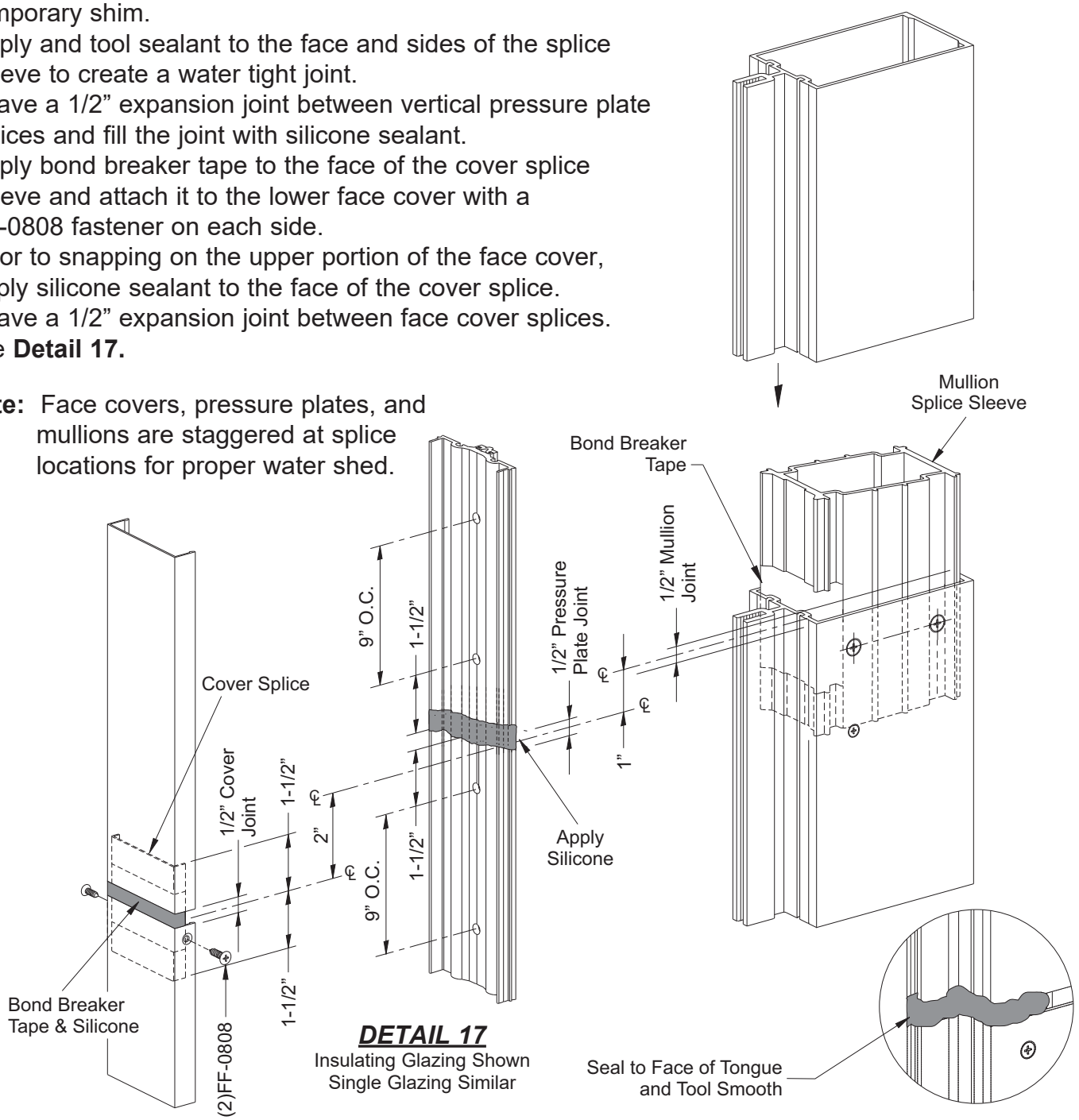
DETAIL 16
Insulating Glazing Shown
Single Glazing Similar

FRAME INSTALLATION

STEP 12
TYPICAL MULLION SPLICE

-Clean all contact surfaces as recommended by sealant manufacturer.
-Apply bond breaker tape to the face of the mullion splice sleeve.
-Carefully slide the next mullion down onto the splice sleeve and place a 1/2” temporary shim between the mullions to properly locate them.
-Secure the upper mullion to the mid anchors and remove the temporary shim.
-Apply and tool sealant to the face and sides of the splice sleeve to create a water tight joint.
-Leave a 1/2” expansion joint between vertical pressure plate splices and fill the joint with silicone sealant.
-Apply bond breaker tape to the face of the cover splice sleeve and attach it to the lower face cover with a FF-0808 fastener on each side.
-Prior to snapping on the upper portion of the face cover, apply silicone sealant to the face of the cover splice.
-Leave a 1/2” expansion joint between face cover splices.
See **Detail 17.**

Note: Face covers, pressure plates, and mullions are staggered at splice locations for proper water shed.



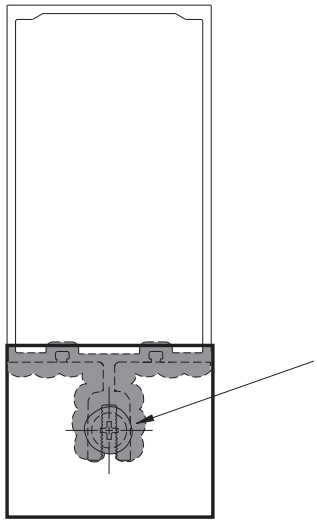
DETAIL 17
Insulating Glazing Shown
Single Glazing Similar

FRAME INSTALLATION

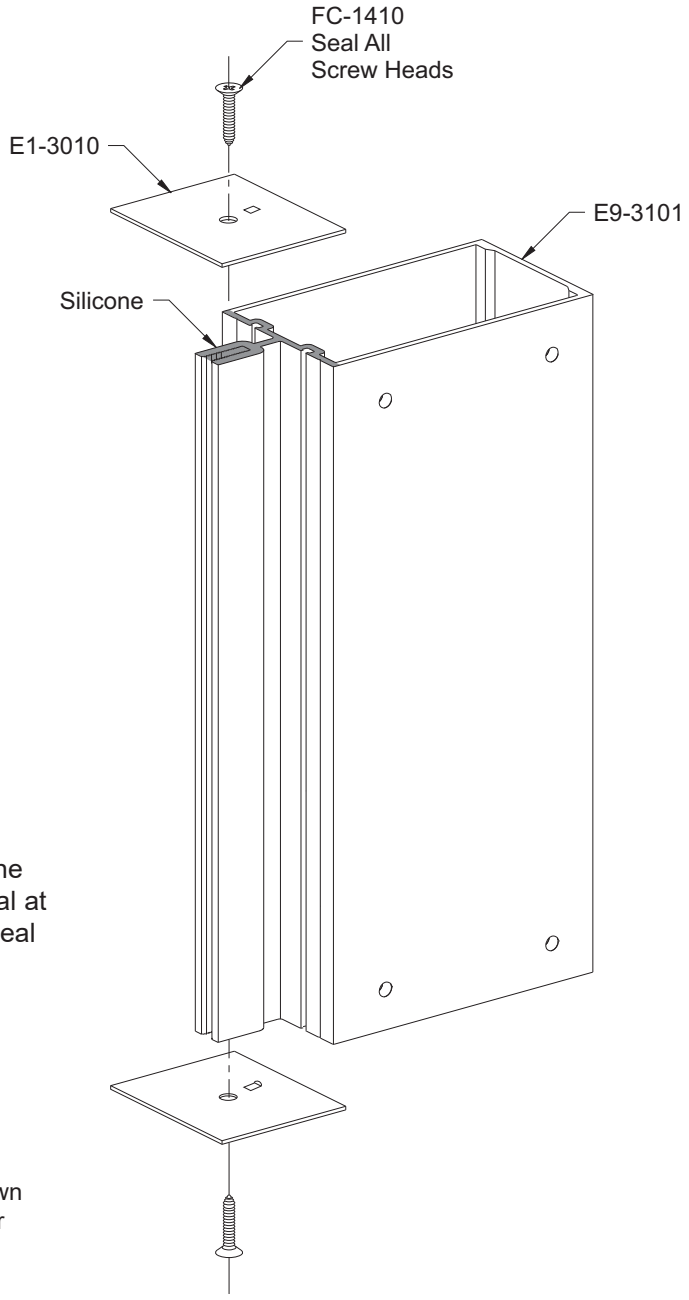
STEP 13
INSTALL MULLION END CAPS

-Clean all contact surfaces as recommended by the sealant manufacturer.
-Apply silicone sealant to screw raceway and edge of mullion prior to installing mullion end caps, E1-3010 for E9-3101 (insulating glazing) or E1-3011 for E9-3103 (single glazing).
-Prior to erecting vertical mullions, install mullion end caps using one FC-1410 fastener at each end of the mullion.
-Apply and tool sealant to all screw heads.

See **Detail 18.**



Note:
Seal mullion end cap water tight with silicone sealant around vertical at top and bottom and seal all screw heads.



DETAIL 18
Insulating Glazing Shown
Single Glazing Similar

CAUTION: Make sure that mullion end cap location does not interfere with the installation of mullion end anchors.

FRAME INSTALLATION

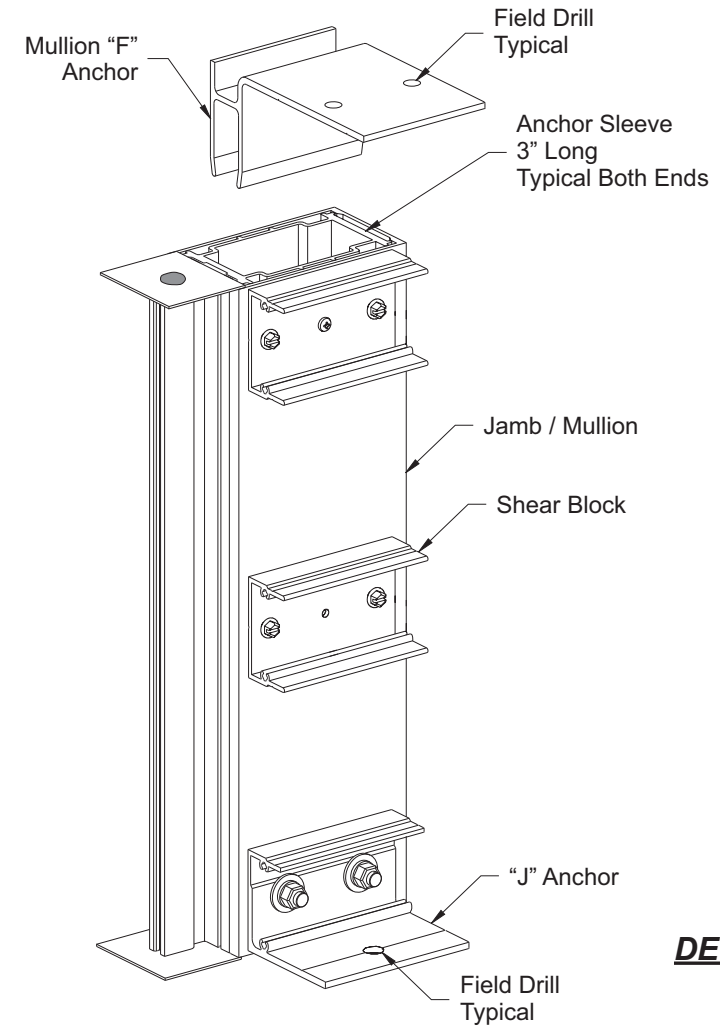
STEP 14
INSTALL JAMB AND INTERMEDIATE MULLIONS

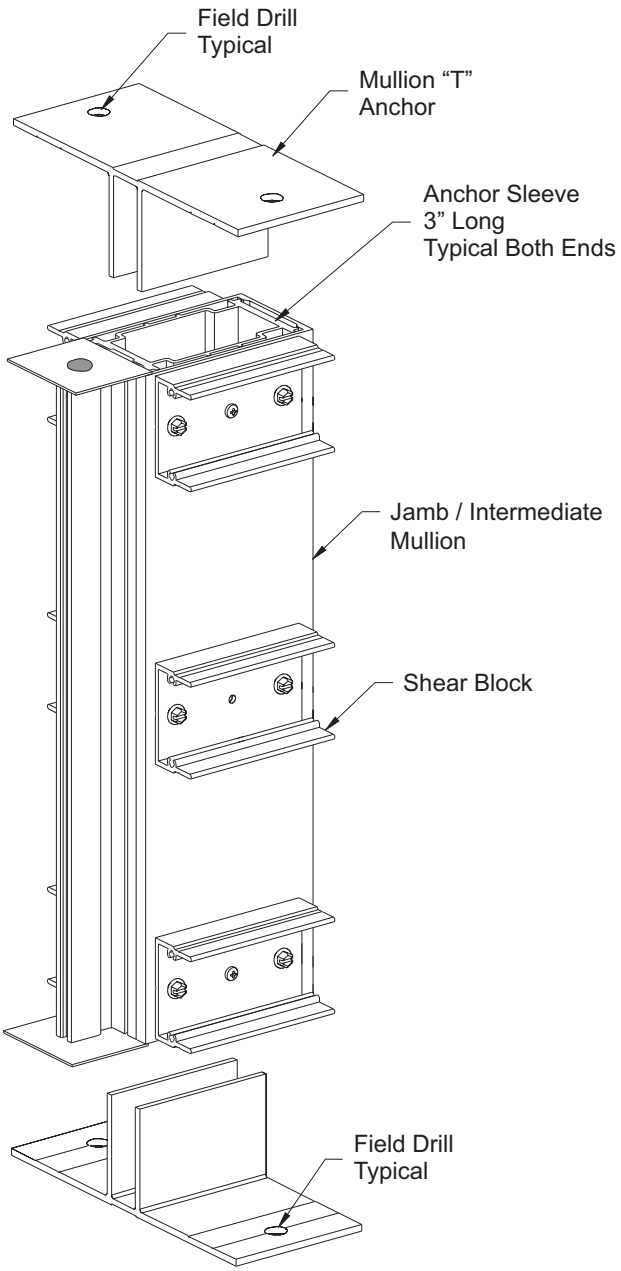
-Insert mullion “T” anchors and “F” anchors into the top and bottom of the mullions before erecting them into the opening.
-Erect and locate the jamb and intermediate mullions and temporarily attach them to the structure.

Note: All mullions must be installed plumb and true.

-Field drill holes in “T”, “F”, and “J” anchors for appropriate anchor fasteners according to engineering calculations. Consult YKK AP if load requirements are in question.

See **Detail 19**.





DETAIL 19

FRAME INSTALLATION

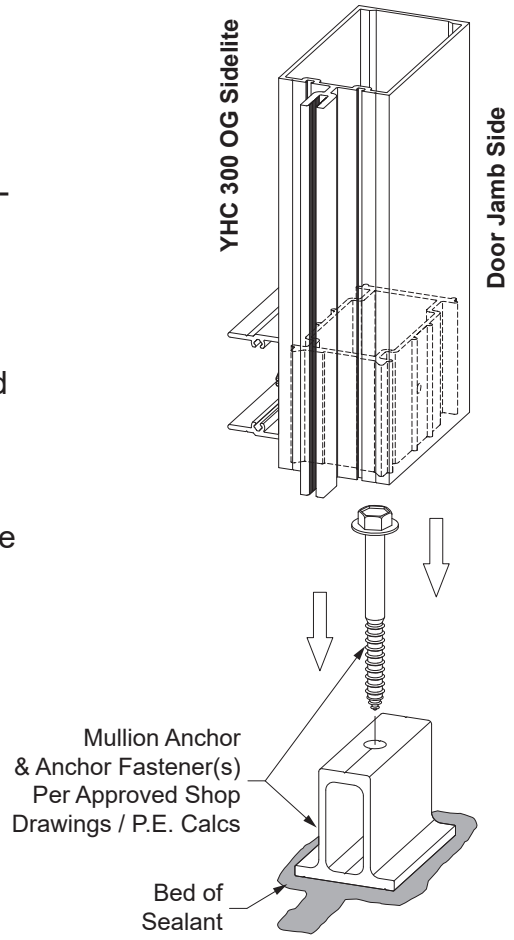
STEP 14A
VERTICAL INSTALLATION
AT DOOR JAMB END ANCHORS

The mullions at the door jambs are set directly upon the sill substrate without any shims and are sealed against the substrate. The anchors to be used at this location are specified by the approved shop drawings and or P.E. calculations.

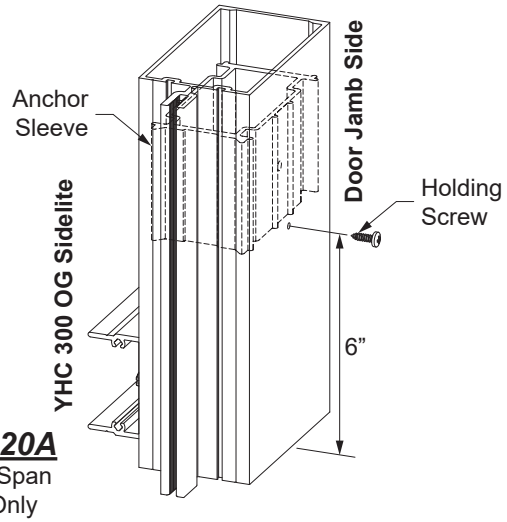
-Locate the mullion anchor for the door jamb and install it to the substrate according to the approved shop drawings and P.E. calculations.
-Clean all contact surfaces as recommended by sealant manufacturer.
-Set the mullion on the anchor, directly onto the sill substrate in a bed of sealant. Avoid using shims at this location.
See **Detail 20**.

Note: For single-span elevations, the anchor sleeve must be installed temporarily 6” up from the bottom of the mullion and dropped into place after the mullion is rotated over the side of the door anchor.
See **Detail 20A**.

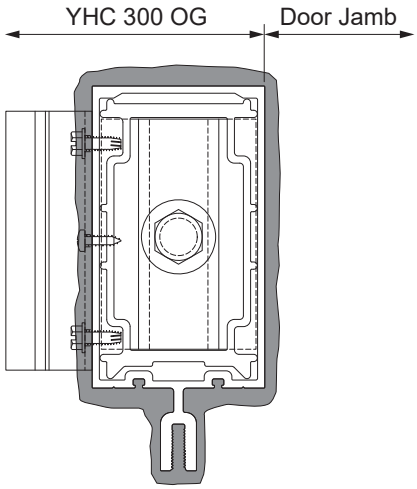
-Refer to the approved shop drawings for any additional fasteners required.
-Tool sealant at the bottom of the mullion at the sill substrate around the perimeter of the mullion.
See **Detail 21**.



DETAIL 20



DETAIL 20A
For Single Span
Mullions Only



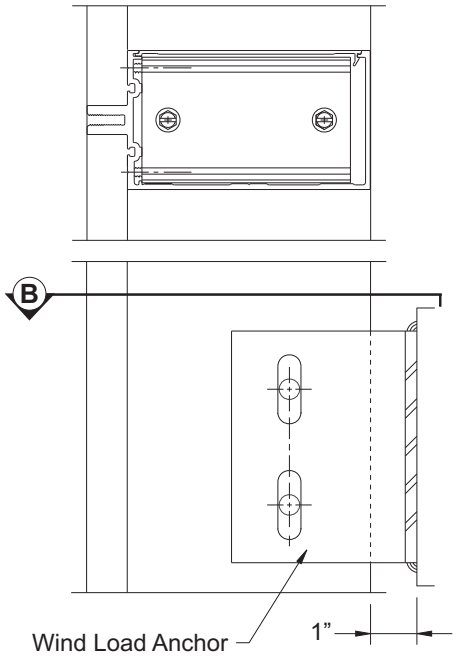
DETAIL 21

FRAME INSTALLATION

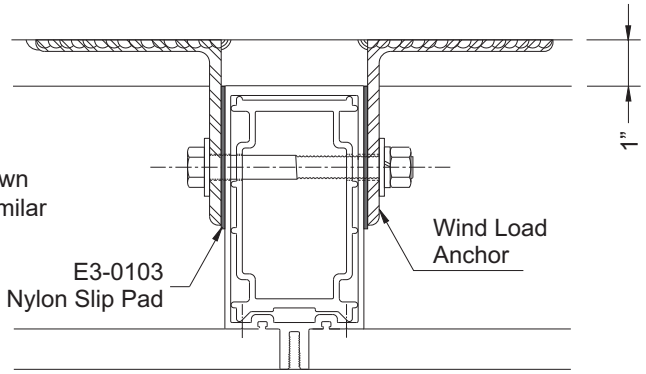
STEP 15
INSTALL WIND LOAD/DEAD LOAD ANCHORS

-Install steel mullion mid anchors:
Wind Load Anchor. See **Detail 22.**
Dead Load Anchor. See **Detail 23.**

Note: Required anchors and bolt size will vary based on project requirements. Consult a qualified professional engineer or YKK AP.

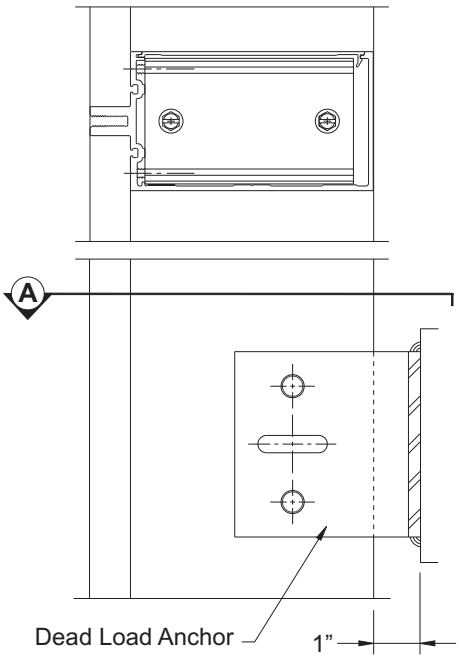


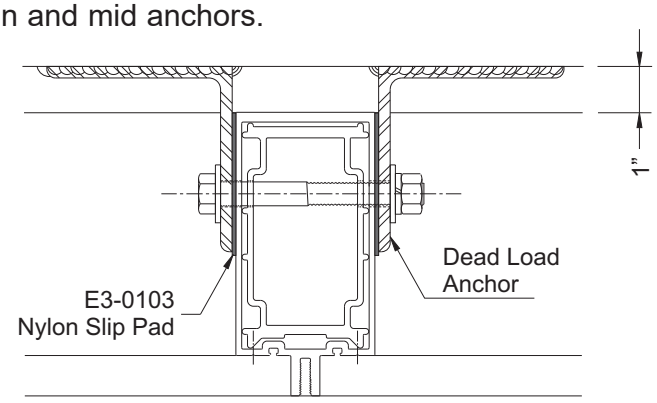
DETAIL 22
Single Glazing Shown
Insulating Glazing Similar



SECTION B

-Mid anchors are normally template or line set before mullions are hung.
-Slotted or drilled leg of clip must be set at 90° to offset leg.
See shop drawings for details of mid anchor attachment.
-Install plumb and align vertical mullions, drill appropriate size holes for anchor bolts as shown in shop drawings.
-Anchor bolts are fastened **after** horizontals are attached.
-Nylon slip pads, E3-0103, **must** be installed between mullion and mid anchors.





DETAIL 23
Single Glazing Shown
Insulating Glazing Similar

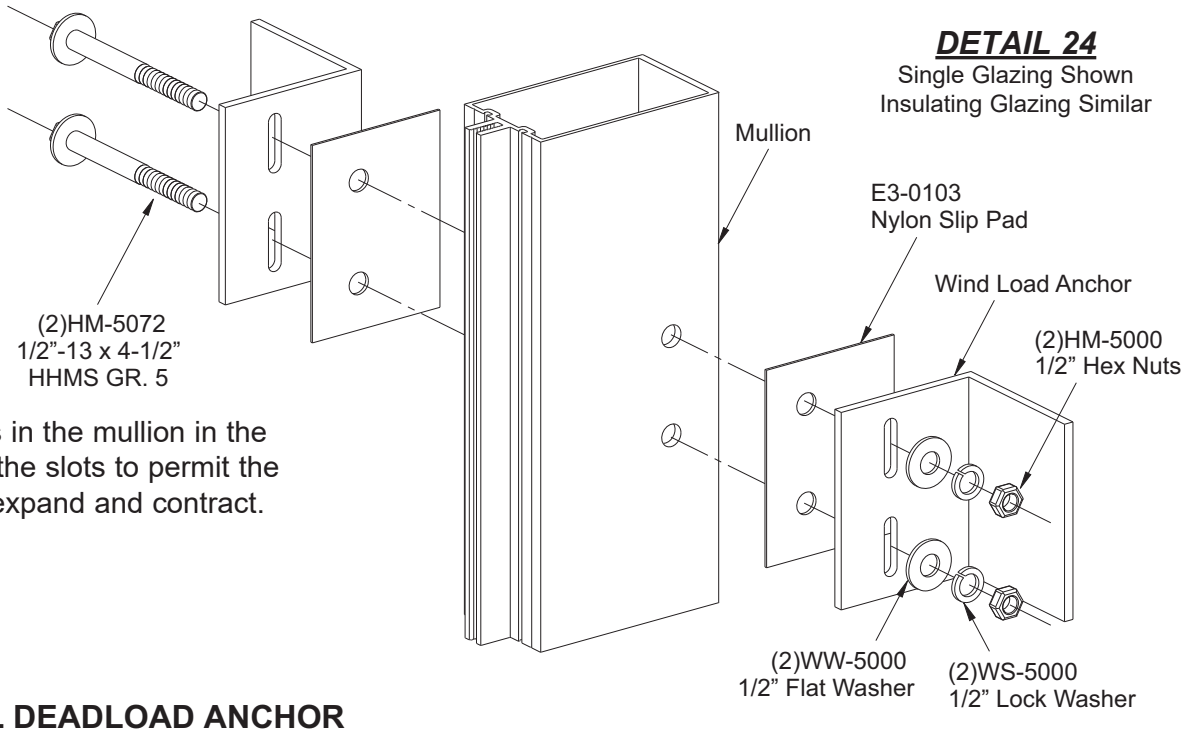
SECTION A

FRAME INSTALLATION

STEP 15 (CONTINUED)
INSTALL WIND LOAD/DEAD LOAD ANCHORS

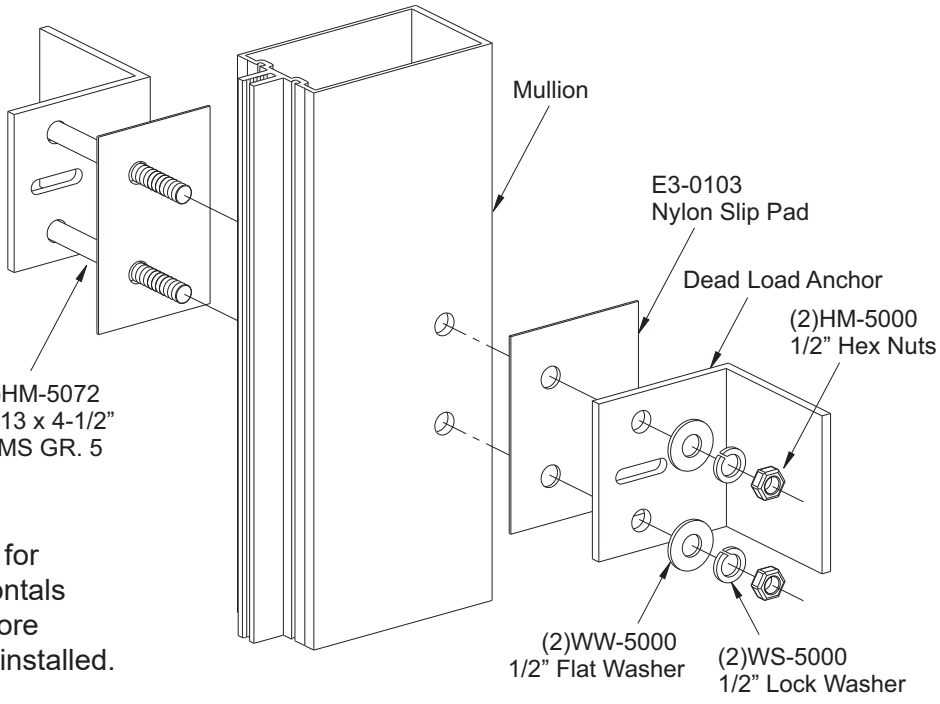
-Refer to shop drawings or engineering calculations for anchor requirements.

TYPICAL WINDLOAD ANCHOR



-Drill holes in the mullion in the center of the slots to permit the frame to expand and contract.

TYPICAL DEADLOAD ANCHOR



DETAIL 25
Single Glazing Shown
Insulating Glazing Similar

Note: Fasteners are shown for reference only; horizontals must be attached before anchor fasteners are installed.

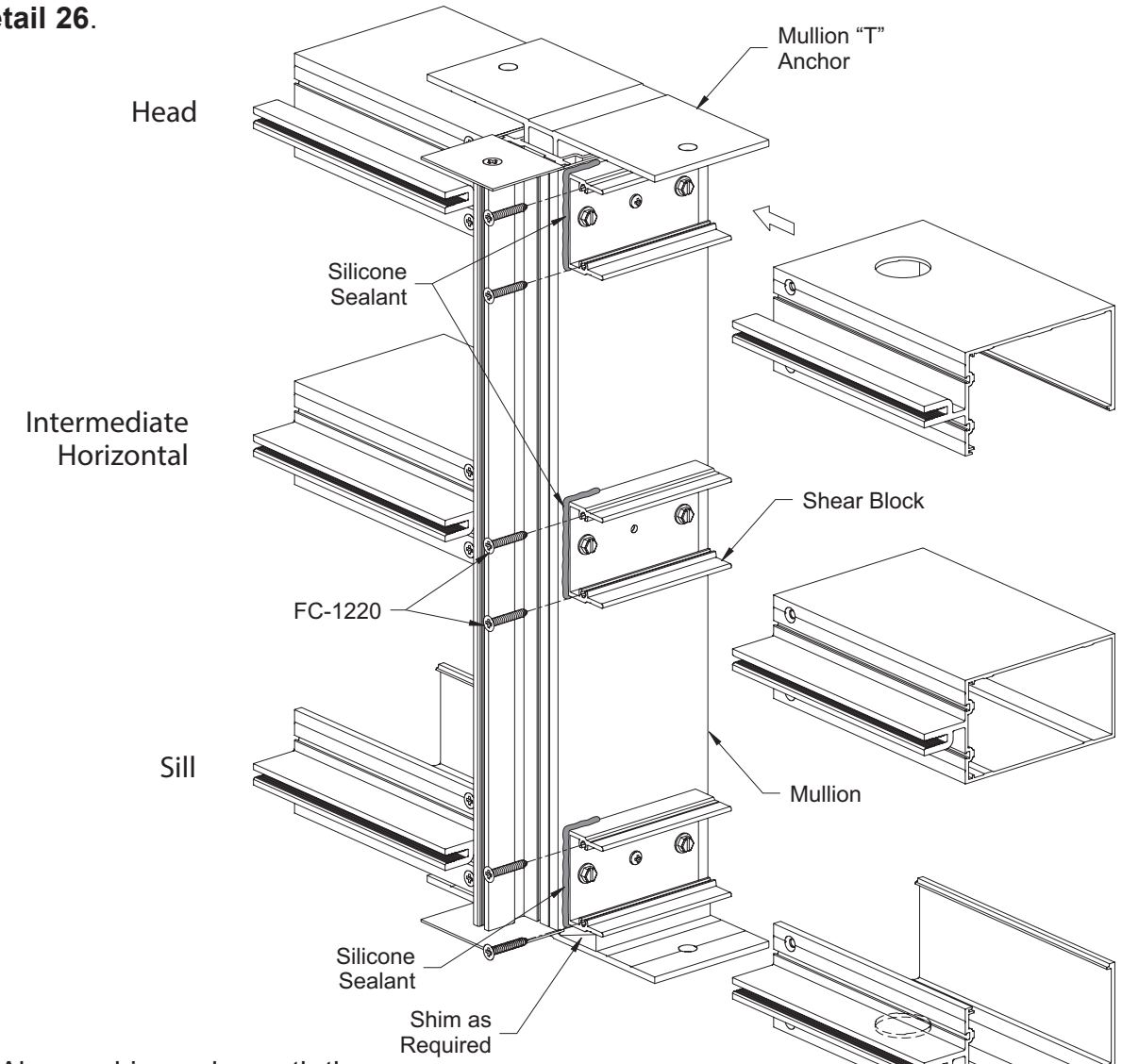
FRAME INSTALLATION

STEP 16
ATTACH HORIZONTAL MEMBERS

Note: Before applying any sealant, clean aluminum surfaces using cleaner and method approved by silicone sealant manufacturer.

-Just prior to attaching the horizontal members to the vertical, apply sealant to the front of the shear block as shown.
-Slide the horizontal members towards the shear blocks and attach them with two FC-1220 fasteners at each end.
-Tool and wipe away any excess sealant.

See **Detail 26**.



DETAIL 26
Insulating Glazing Shown
Single Glazing Similar

Note: Always shim underneath the mullion to transfer glazing dead loads to the foundation.

FRAME INSTALLATION

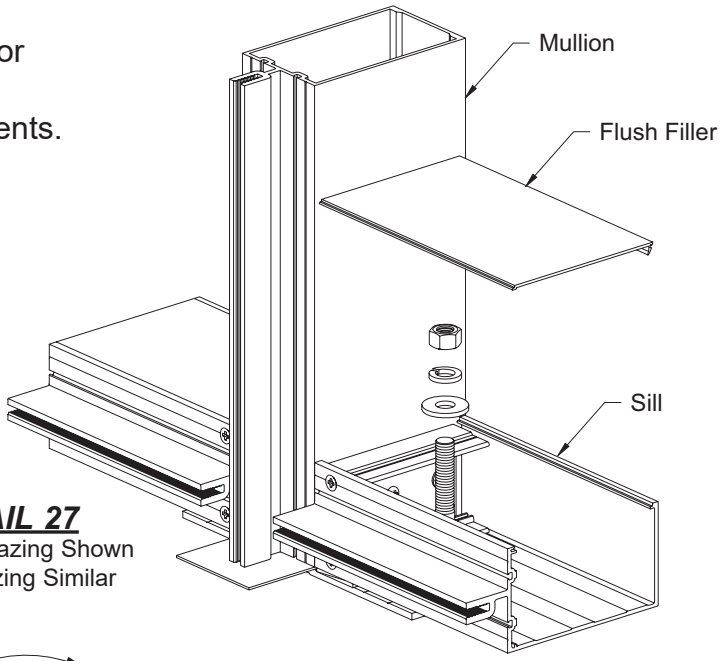
STEP 16 (Continued)
ATTACH HORIZONTAL MEMBERS

-Drill appropriate size holes into the structure for the anchor fasteners.
-Provide anchor fasteners as per job requirements. See approved shop drawings or engineering calculations for appropriate anchor fasteners.
-Install the anchor fasteners.

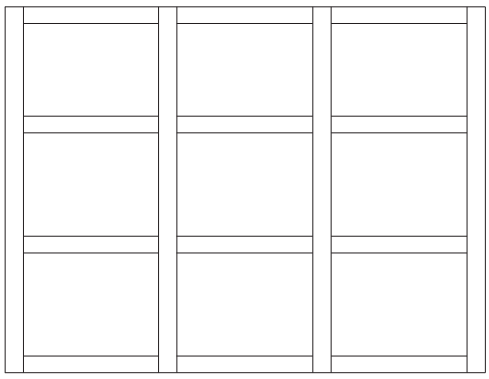
Caution: There must always be a shim under the mullion to transfer glazing dead loads to the foundation.

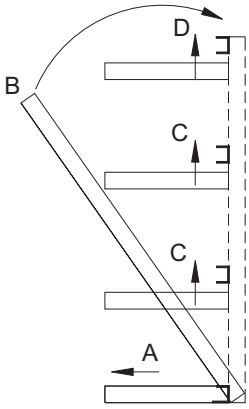
-Install the flush filler after tightening the anchor fasteners.

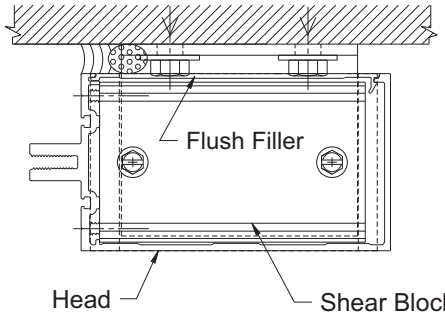
See **Detail 27**.



DETAIL 27
Insulating Glazing Shown
Single Glazing Similar







DETAIL 28
Single Glazing Shown
Insulating Glazing Similar

Horizontal Attachment at End Bays:

A: Bring the horizontal members into position and secure loosely.

B: To install vertical jamb, engage bottom shear block or “J” anchor with the sill member. Pivot vertical jamb member into position and anchor loosely.

C: Use open back horizontal members at intermediate locations, bring them from under the shear clips and lift into position. Fasten the horizontals to the shear blocks.
D: Secure top and bottom end anchors permanently; then install the head member with the open side facing up to clear the shear blocks. Fasten the head member to the shear blocks.

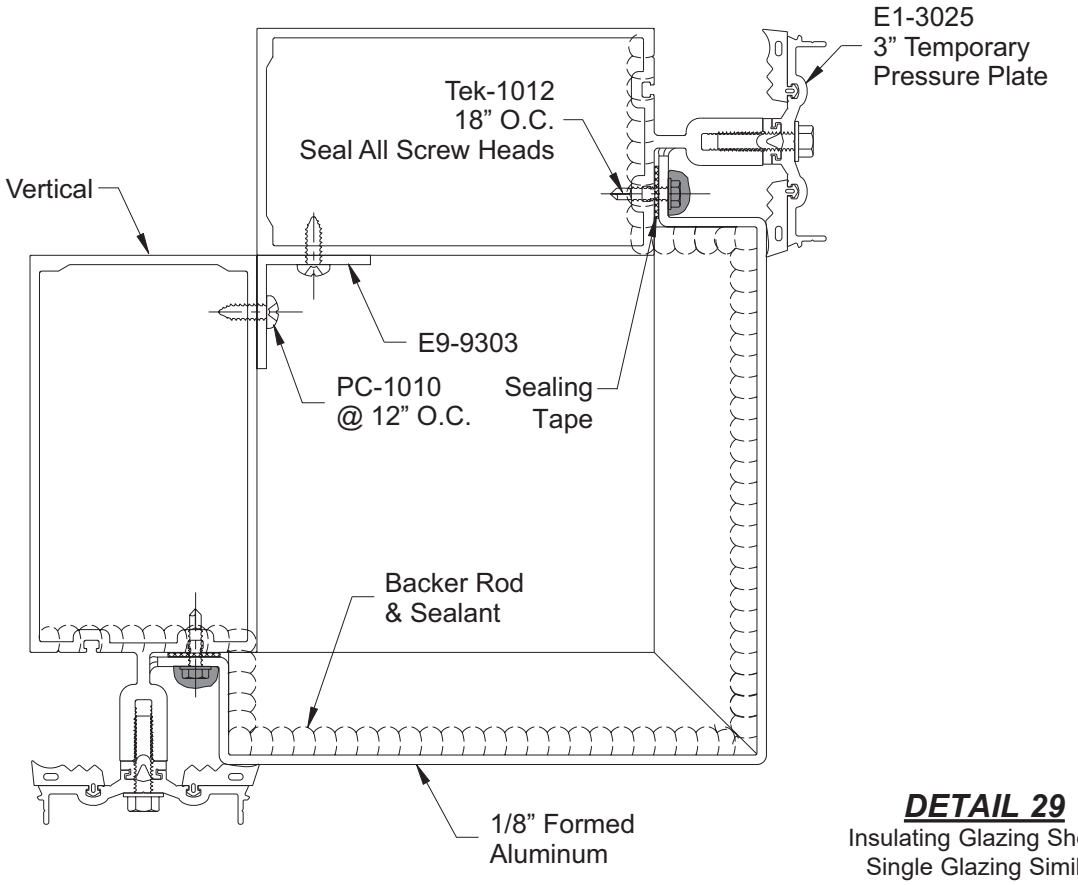
See **Detail 28**.

FRAME INSTALLATION

STEP 17
90° OUTSIDE CORNER ASSEMBLY

-Locate both vertical mullions perpendicular to each other as shown in **Detail 29**.
-Anchor head and sill ends with appropriate end anchors - “J”, “F”, or “T”.
Refer to shop drawings for wind load / dead load anchors.
-Position angle E9-9303 into corner between the two vertical mullions and fasten both legs every 12” on center (o.c.) using PC-1010 fasteners.
-Position 1/8” formed aluminum cover between the verticals and install temporary pressure plates every two to three feet to hold the aluminum cover in place.
-Fasten the aluminum cover to the face of the mullion every 18” on center (o.c.) with 3/4” long #10 Tek screws.
-Seal all exposed screw heads and remove the temporary pressure plates.
-Do not span formed aluminum cover more than 12’-6”; leave 1/2” joint between spans of 12’-6”.
-Clean area around joint with isopropyl alcohol (50%) and wipe clean with lint free cotton cloths using the “two cloth method”.
-Compress backer rod into the 1/2” joint. Apply and tool silicone sealant to the joint.

See **Detail 29**.



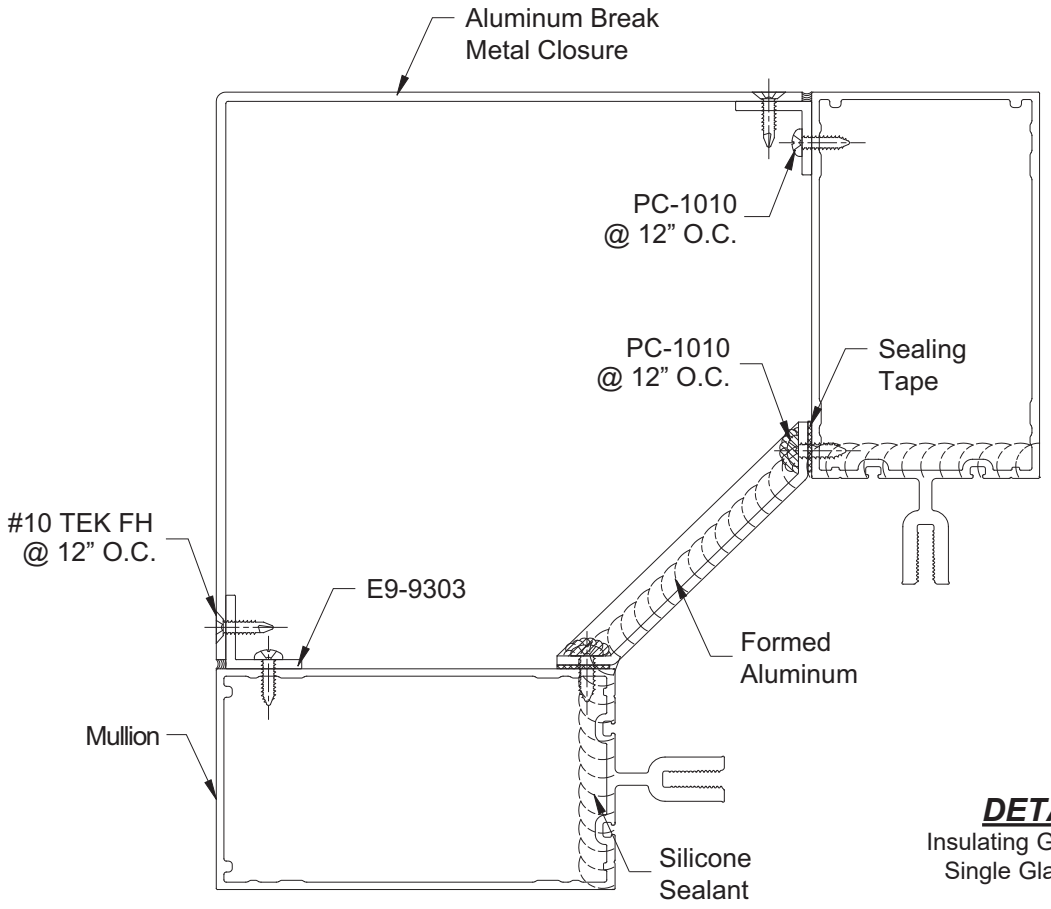
DETAIL 29
Insulating Glazing Shown
Single Glazing Similar

FRAME INSTALLATION

STEP 17
90° INSIDE CORNER ASSEMBLY

-Locate both vertical mullions as shown in **Detail 30**.
-Anchor head and sill ends with appropriate end anchors - “J”, “F”, or “T”.
Refer to shop drawings for wind load / dead load anchors.
-Position 1/8” formed aluminum cover between the verticals and fasten to mullions with PC-1010 at 12” on center. Seal the screw heads.
-Position angle E9-9303 and at the end of the mullions as shown in **Detail 30**, and fasten with PC-1010 at 12” on center.
-Fasten the aluminum closure to angle E9-9303 every 18” on center (o.c.) with 3/4” long #10 Tek screws.
-Do not span formed aluminum cover more than 12’-6”; leave 1/2” joint between spans of 12’-6”.
-Clean area around joint with isopropyl alcohol (50%) and wipe clean with lint free cotton cloths using the “two cloth method”.
-Compress backer rod into the 1/2” joint. Apply and tool silicone sealant to the joint.

See **Detail 30**.



DETAIL 30
Insulating Glazing Shown
Single Glazing Similar

FRAME INSTALLATION

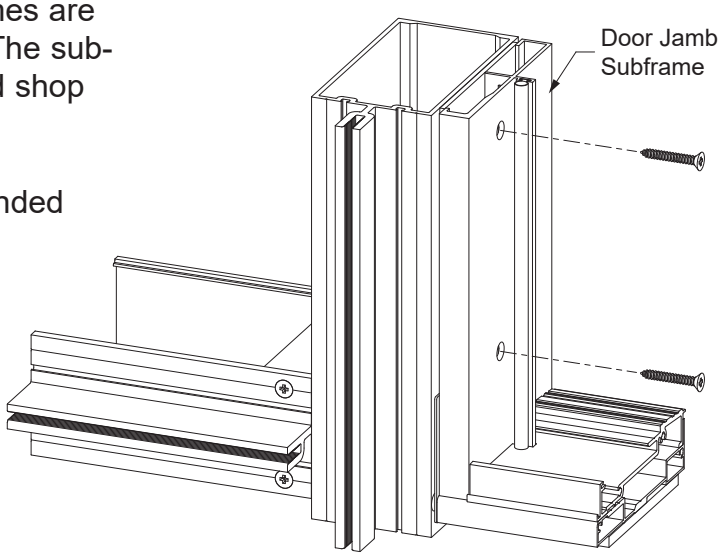
STEP 17
INSTALL DOOR SUBFRAMES

Refer to the **35H/50H Door Installation Manual** for assembly of the door subframes. These subframes are installed into the curtain wall framing members.The sub-frame members are determined by the approved shop drawings.

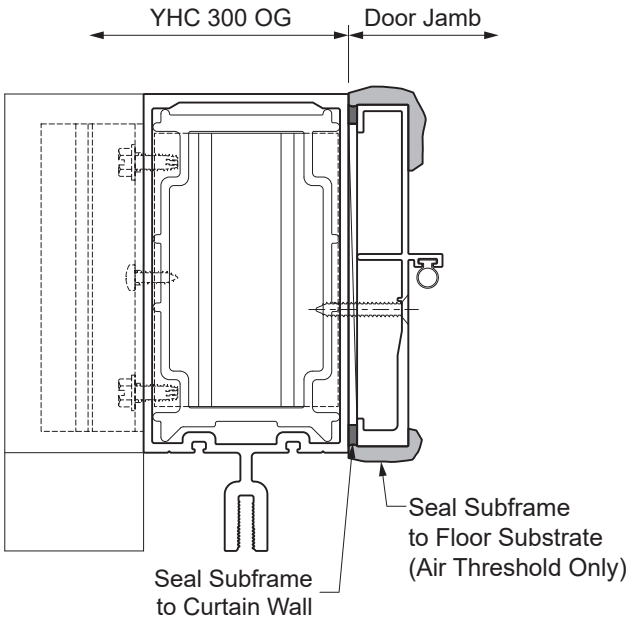
-Clean all sealant contact surfaces as recommended by the sealant manufacturer.

-Install the jamb subframe onto the mullion with fasteners according to the approved shop drawings and/or P.E. calculations. For air-resistant thresholds, set the jamb subframes in a bed of sealant at the floor substrate.

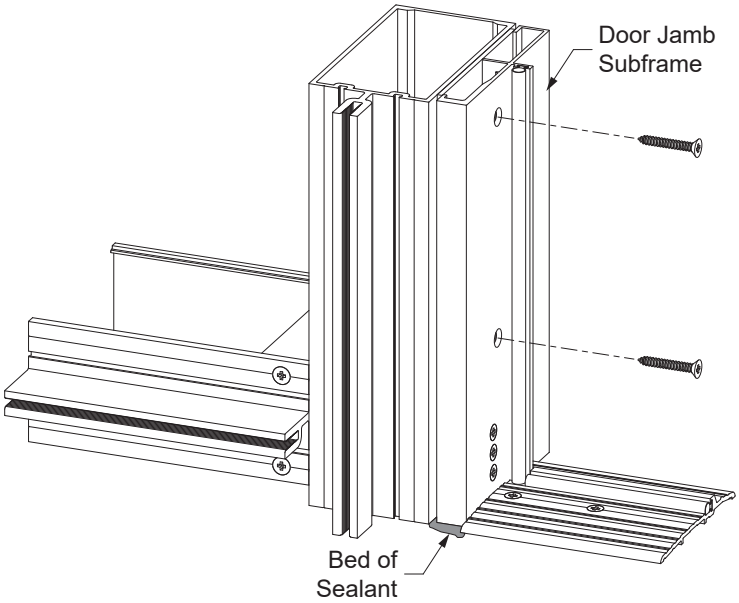
-Apply and tool sealant between the door jamb subframe and the curtain wall framing. For air-resistant thresholds, apply and tool sealant to the bottom of the jamb subframe as shown in **Details 32 & 33**.



Detail 31
Water-resistant
Threshold Shown



Detail 32



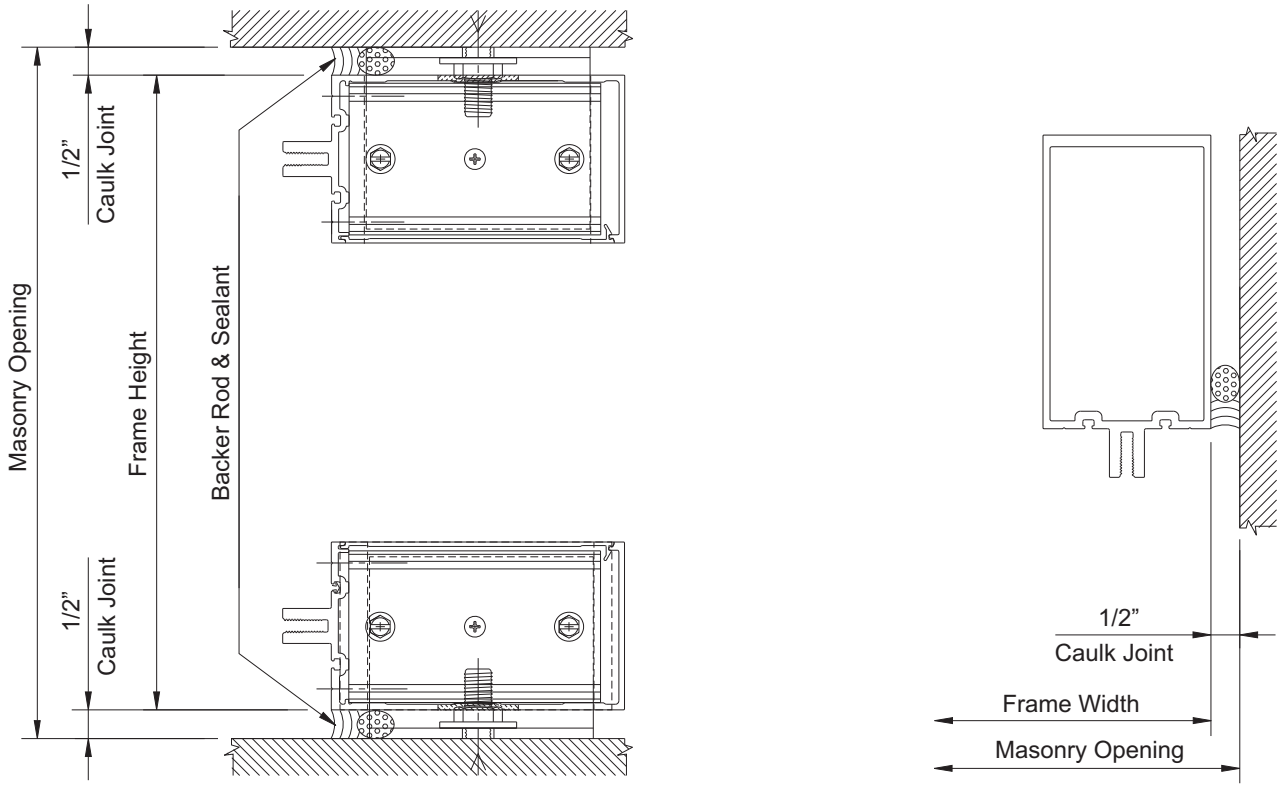
Detail 33
Air-resistant
Threshold Shown

FRAME INSTALLATION

STEP 18
APPLY PERIMETER SEALANT

-Position backer rod around the perimeter of the frame.
-Clean area around the perimeter of the frame with isopropyl alcohol (50%) and wipe clean with lint free cotton cloths using the “two cloth method”.
-Apply silicone sealant to the perimeter of the frame.

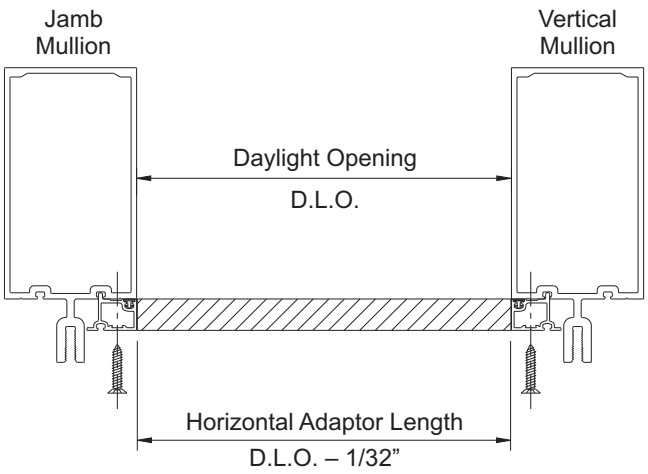
See **Detail 34**.

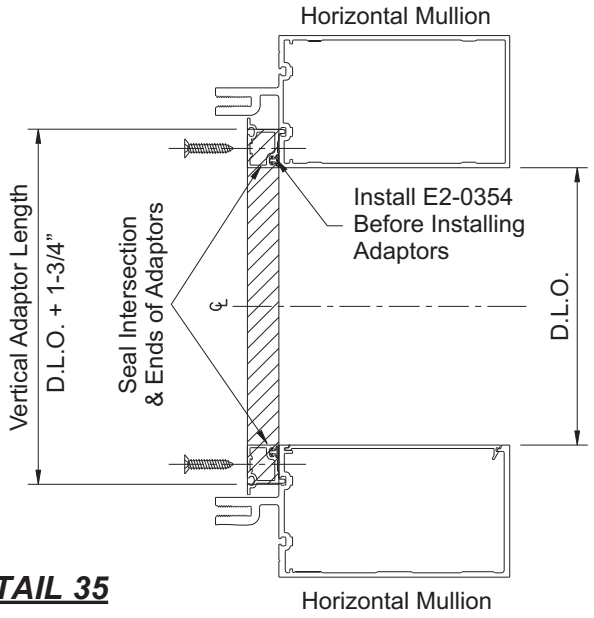


DETAIL 34
Single Glazing Shown
Insulating Glazing Similar

GLAZING

STEP 19
INSTALL 1/4” GLAZING ADAPTORS (When Required)



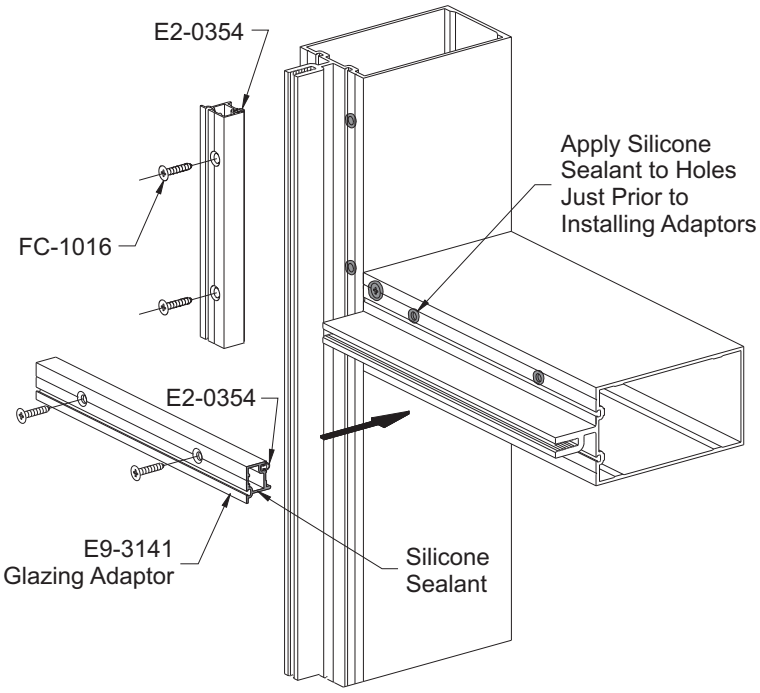


DETAIL 35

-Cut glazing adaptors for verticals:
Cut Length = D.L.O. plus(+) 1-3/4”.
-Cut glazing adaptors for horizontals:
Cut Length = D.L.O. minus(–) 1/32”.

-Slide bulb gasket, E2-0354, into the reglet at the back of the glazing adaptors.
-Predrill 0.213” dia. holes countersunk for #10 fastener along the “V”-groove of each adaptor: 2” from each end and 18” on center or as directed by P.E. calculations.
-Center the vertical glazing adaptors along the opening as shown.

-Dry fit the glazing adaptors and match drill 0.161” dia. holes in the mullion.
-Remove the glazing adaptors and apply silicone sealant over the drilled holes.
-Reinsert the adaptors and secure them to the mullions with FC-1016 fasteners.
-Install vertical adaptors first and butter each end of the horizontal adaptors with silicone sealant before installing them.



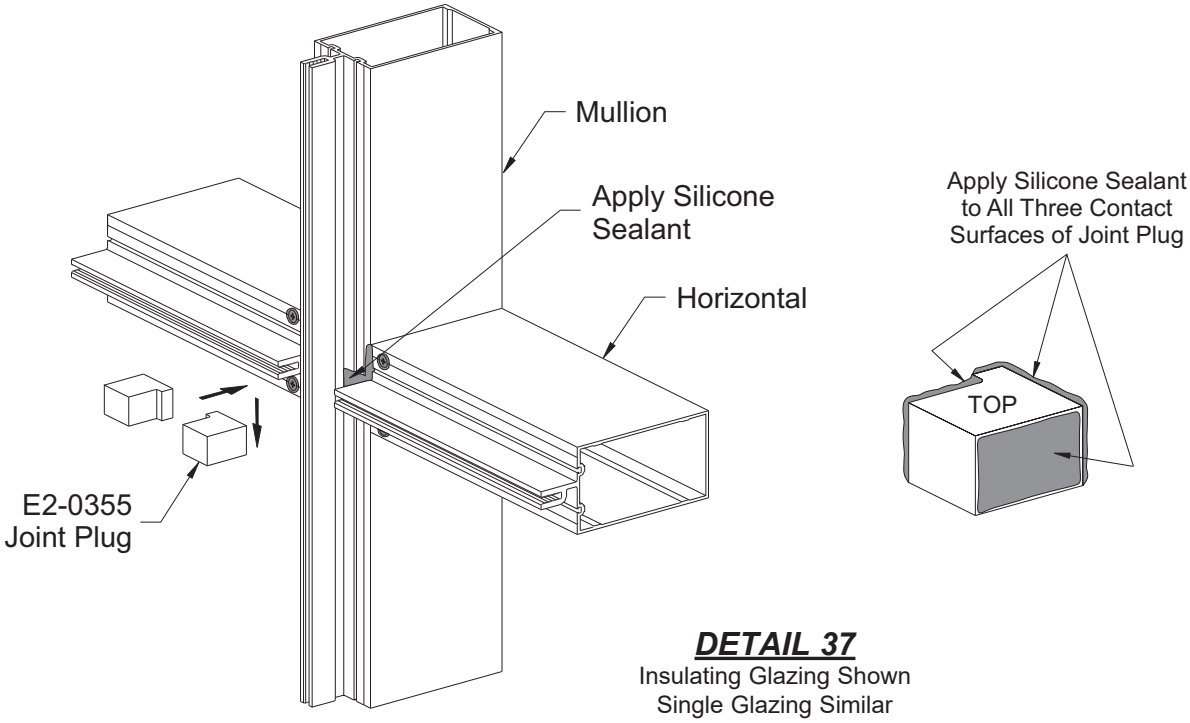
DETAIL 36

See **Details 35 & 36**.

GLAZING

STEP 20
INSTALL JOINT PLUGS

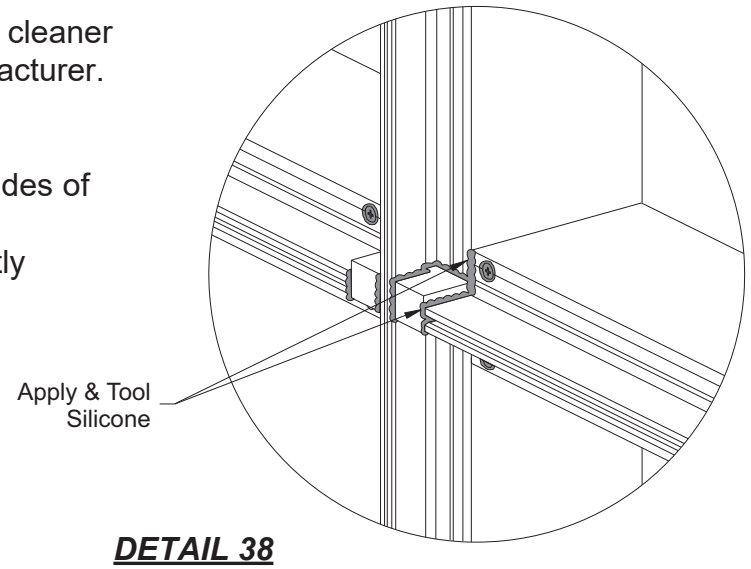
The tongue of all horizontals must be sealed to the tongue of the mullion.
The space between the two tongues is plugged with joint plugs, E2-0355 for insulating glazing or E2-0358 for single glazing.



DETAIL 37
Insulating Glazing Shown
Single Glazing Similar

-Clean the mullion to horizontal joints with a cleaner and method as approved by sealant manufacturer.
-Apply and tool tested silicone sealant to the vertical to horizontal joints.
-Apply silicone sealant to all three contact sides of the joint plugs.
-Apply silicone sealant into all cavities directly behind where each joint plug will go.
-Insert the joint plugs into the opening and press them firmly against the face of the mullions.

See **Details 37 & 38**.

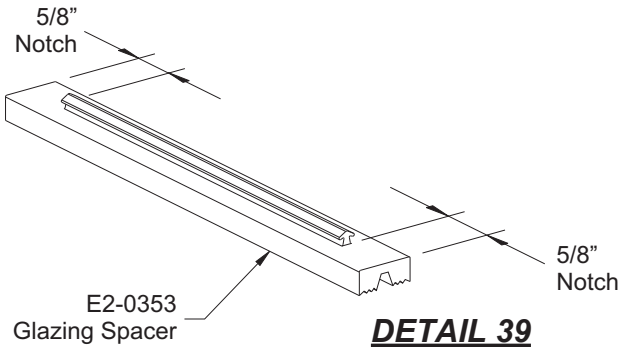


DETAIL 38

GLAZING

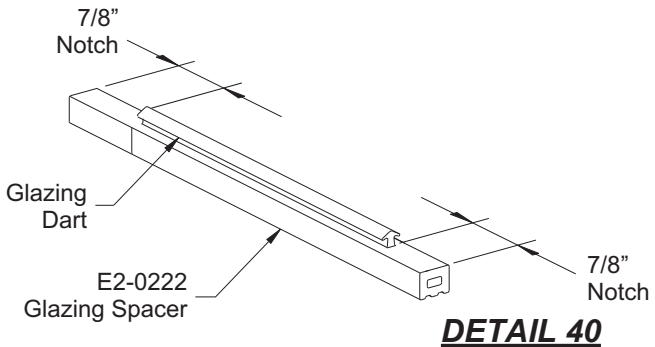
STEP 21
INSTALL STRUCTURAL GLAZED INTERIOR GLAZING SPACERS

For applications below 90 PSF
-Cut interior vertical glazing spacers, E2-0353, to daylight opening plus(+) 2".
-Cut the horizontal glazing spacers, E2-0353, to daylight opening plus(+) 1-1/4".
-Trim off 5/8" of the glazing dart at each end of the horizontal glazing spacers.
See **Detail 39**.



DETAIL 39

For applications above 90 PSF
-Cut interior vertical glazing spacers, E2-0222, to daylight opening plus(+) 2".
-Cut the horizontal glazing spacers, E2-0222, to daylight opening plus(+) 1-3/4".
-Trim off 7/8" of the glazing dart at each end of the horizontal glazing spacers.
See **Detail 40**.



DETAIL 40

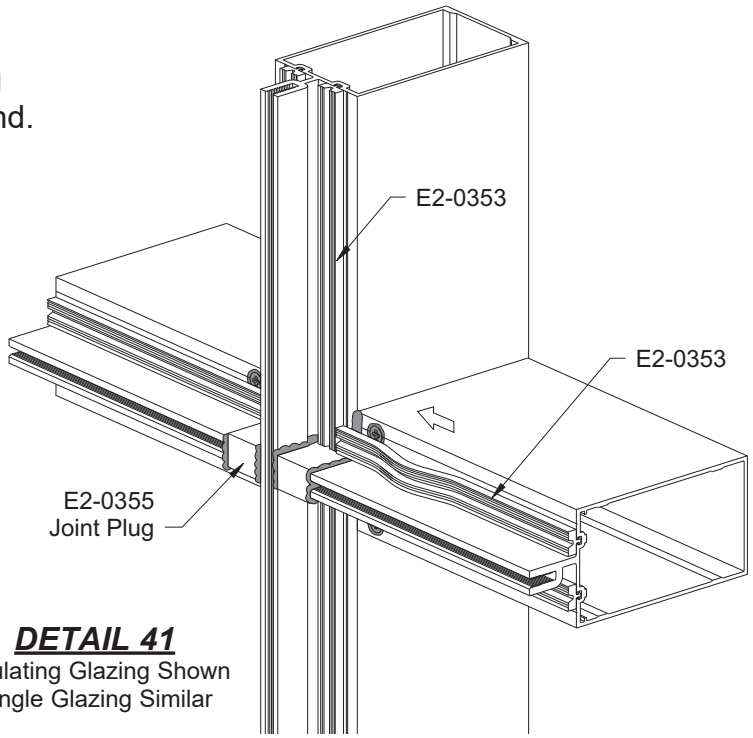
-Install vertical glazing spacers first:
  -Install vertical glazing spacer centered along the daylight opening.
  -Insert the spacer into the reglet starting at the center and work towards each end.

Note: **Do not** stretch the glazing spacer while installing it into the reglet.

-Install horizontal glazing spacers next:
  -Insert the glazing spacer into the reglet at each end first.
  -Install the rest of the glazing spacer into the reglet starting at the center and work towards each end.

Note: Horizontal spacer ends should always butt into the vertical spacer.

See **Detail 41**.

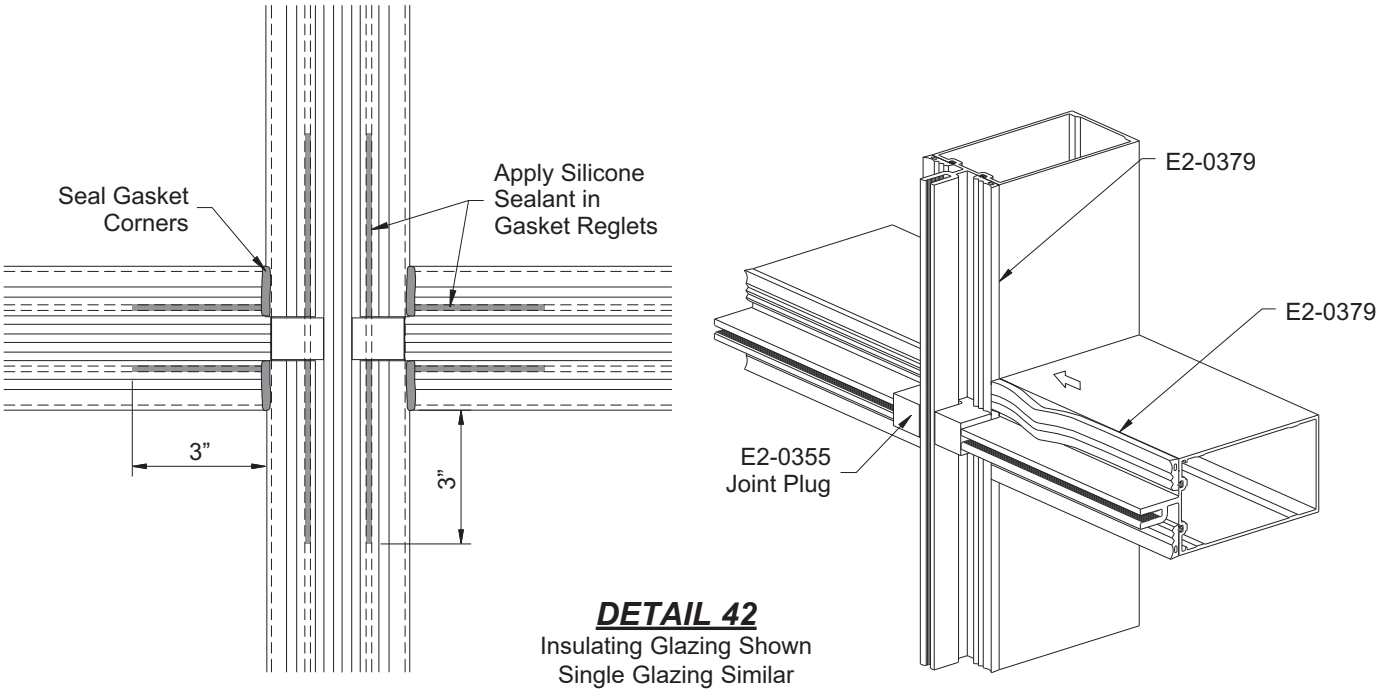


DETAIL 41
Insulating Glazing Shown
Single Glazing Similar

GLAZING

STEP 22
INSTALL INTERIOR DRY GLAZED GLAZING GASKETS

-Cut vertical glazing gaskets, E2-0379, to daylight opening plus(+) 2”.
-Cut the horizontal glazing gaskets, E2-0379, to daylight opening plus(+) 3/16” for each foot of opening width.



DETAIL 42
Insulating Glazing Shown
Single Glazing Similar

-Just prior to installing the gaskets, apply silicone sealant to the gasket reglets at the horizontal / vertical intersections as shown in **Detail 42**.
-Install vertical glazing gaskets first:
  -Install vertical glazing gasket centered along the daylight opening.
  -Insert the gasket into the reglet starting at the center and work towards each end.
-Install horizontal glazing gaskets next:
  -Apply silicone sealant to both ends of the horizontal glazing gasket.
  -Insert the glazing gasket into the reglet at each end first. Then install the rest of the glazing gasket into the reglet starting at the center and work towards each end.
  -Tool the excess sealant at the gasket corners to ensure a watertight seal.

Note: Do not stretch the glazing gasket while installing it into the reglet.

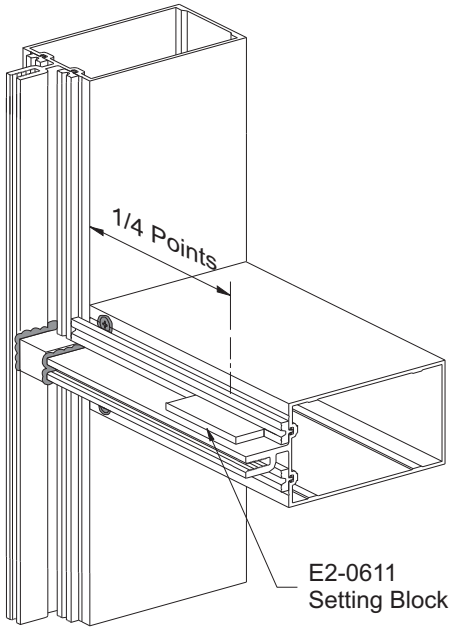
See **Detail 42**.

GLAZING

STEP 23
INSTALL GLASS

-Clean all glazing surfaces and joints of foreign matter and contaminants such as grease, oil, dust, frost, and surface dirt. Do not use water or soap to clean surfaces or to tool the sealant.
-Install setting blocks, E2-0611 for insulating glazing or E2-0623 for single glazing, at 1/4 points of horizontal.
-Install side blocks, E2-0537, centered along the daylight opening on both sides of the glazing material.

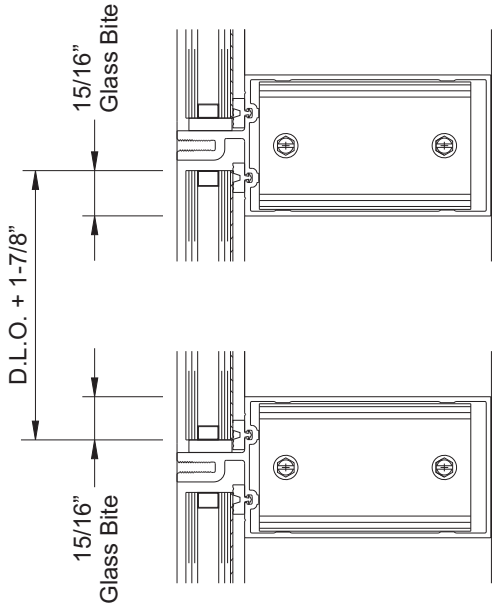
See **Detail 43**.



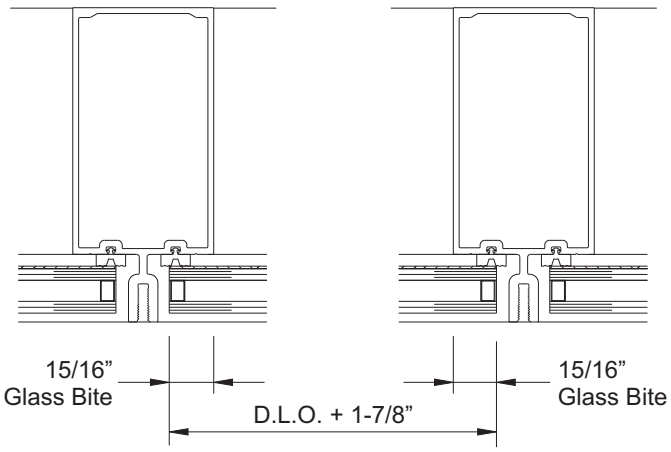
DETAIL 43
Insulating Glazing Shown
Single Glazing Similar

-Clean all silicone contact surfaces and joints with a cleaner and method as approved by sealant manufacturer.
-Carefully install glass into the frame. Make sure setting blocks and spacers are properly aligned with glass.
-Install temporary pressure plates 18” on center both horizontally and vertically.

See **Details 44 & 45**.



DETAIL 44
Insulating Glazing Shown
Single Glazing Similar



GLASS SIZE = D.L.O. + 1-7/8”
(HORIZONTAL & VERTICAL)

GLAZING

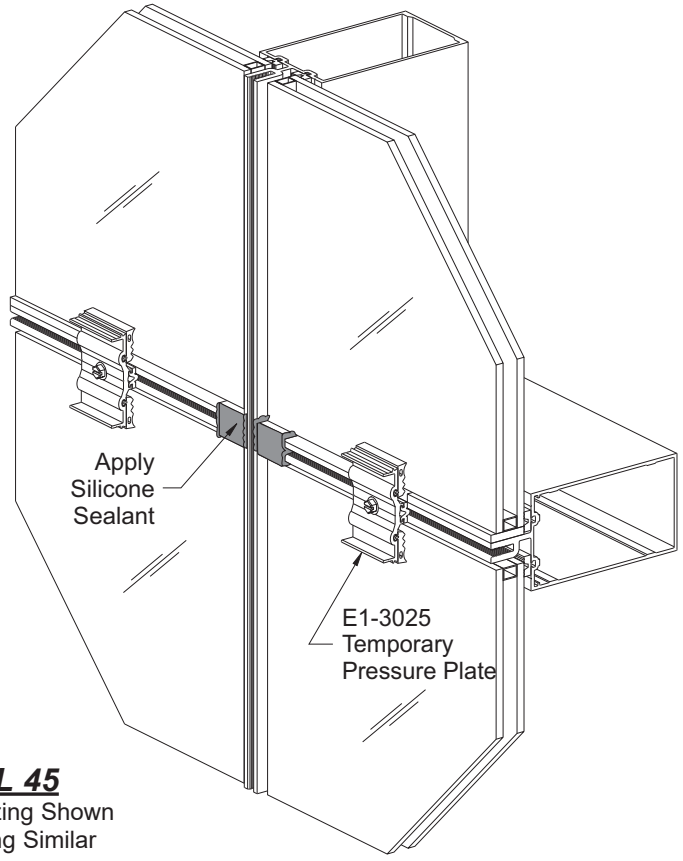
STEP 24
INSTALL PRESSURE PLATES

-Cut exterior vertical gaskets to the same length as the vertical pressure plates.
-Cut exterior horizontal gaskets to daylight opening plus(+) 1/4” for shrinkage.
-Install by pushing the exterior gaskets into the reglets of the pressure plates.

Note: See Glazing Table below for proper gasket usage.

-Apply silicone sealant to face of joint plug just prior to installing vertical pressure plate. Sealant must form a complete seal between the exterior gasket, the pressure plate, the thermal isolator, and the joint plugs.

See **Detail 45**.



DETAIL 45
Insulating Glazing Shown
Single Glazing Similar

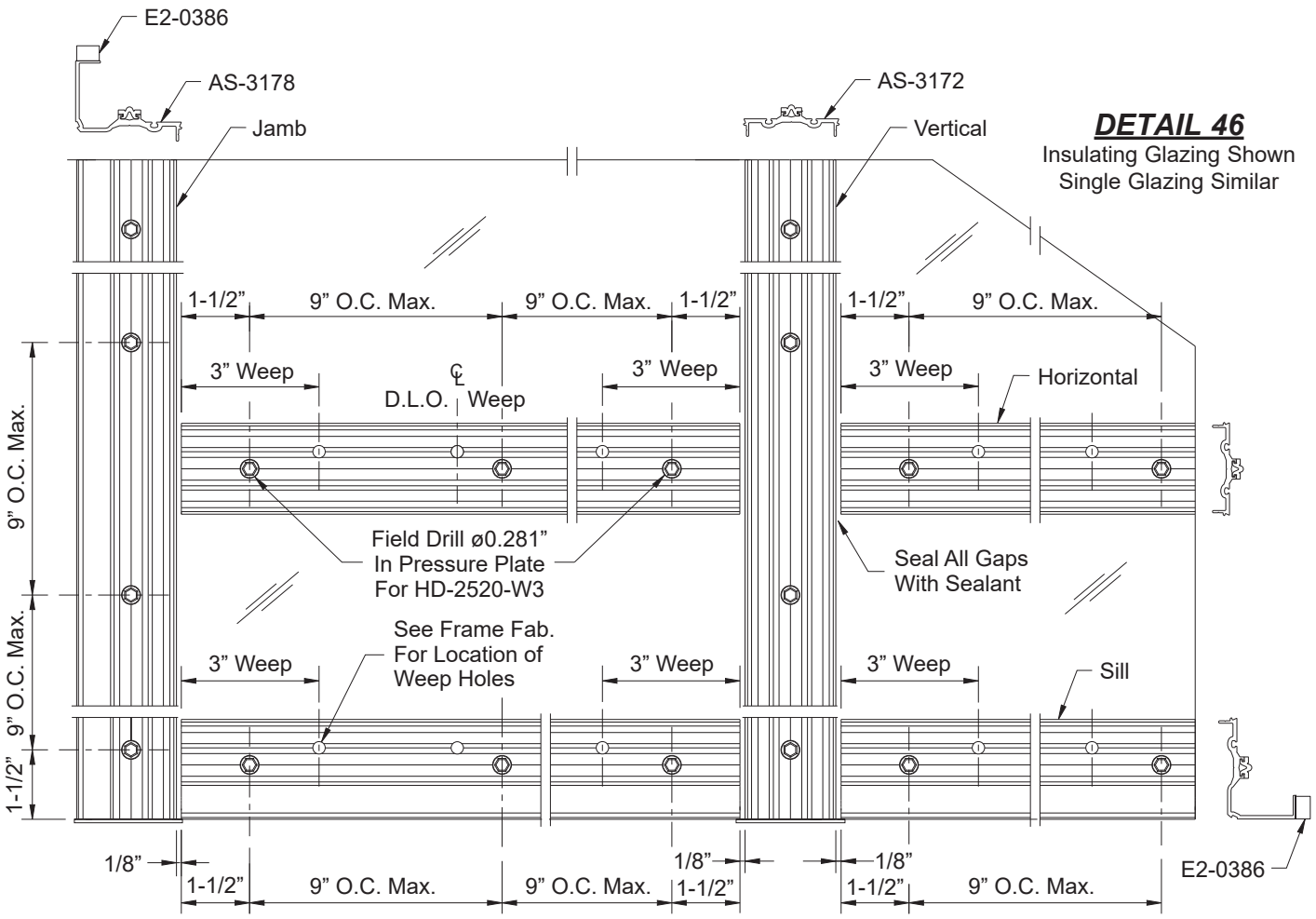
YHC 300 OG GLAZING TABLE

Glass Size		Exterior Gasket	Dry Glazed Interior Gasket	Wet Glazed Interior Spacer	Glazing Adaptor	Pressure Plate	Perimeter P. Plate
Single	1/4”	E2-0380	E2-0380	E2-0353*	—	AS-3173	AS-3179
	9/16”	E2-0379	E2-0379	E2-0353*	—	AS-3173	AS-3179
Insulating	9/16”	E2-0379	E2-0379	E2-0353*	E9-3141	AS-3172	AS-3178
	1”	E2-0380	E2-0380	E2-0353*	—	AS-3172	AS-3178
	1-5/16”	E2-0379	E2-0379	E2-0353*	—	AS-3172	AS-3178

* Interior Spacer E2-0222 will be used for design pressures above 90 PSF.

GLAZING

STEP 24 (Continued)
INSTALL PRESSURE PLATES



-Apply isolator tape, E2-0386, to the inside leg of all perimeter pressure plates.

-Install vertical pressure plates first: Fasten with HD-2520-W3 fasteners.
-Initially torque fasteners to 50 inch-pounds with a speed wrench or torque limiting screw gun. Work from the bottom up.
-Torque all fasteners to 75 inch-pounds.

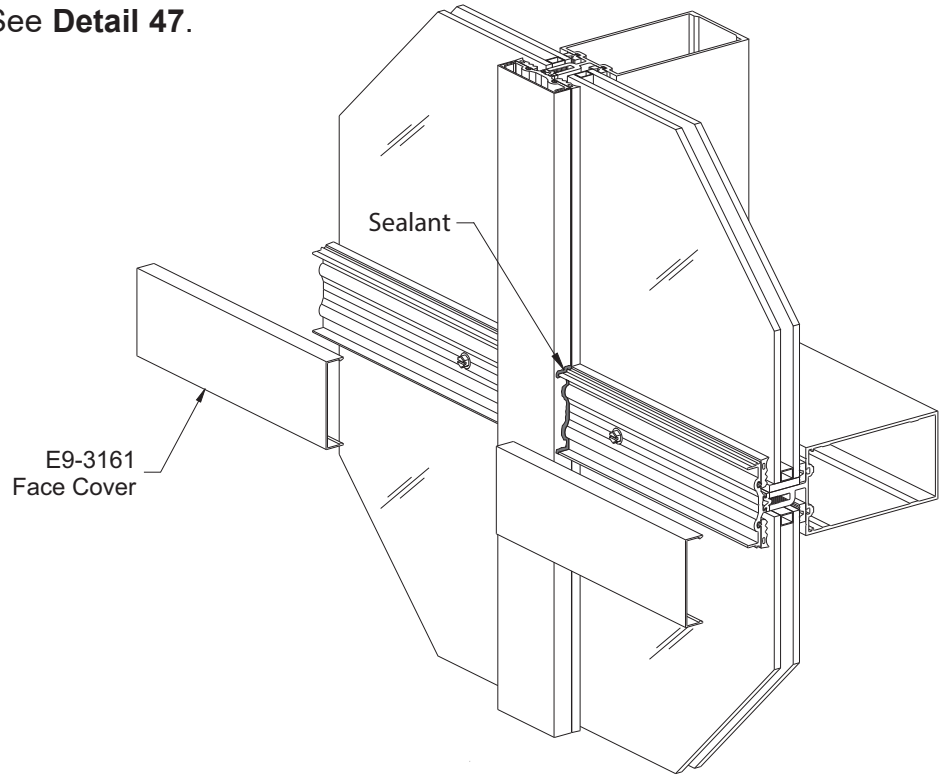
See **Detail 46**.

GLAZING

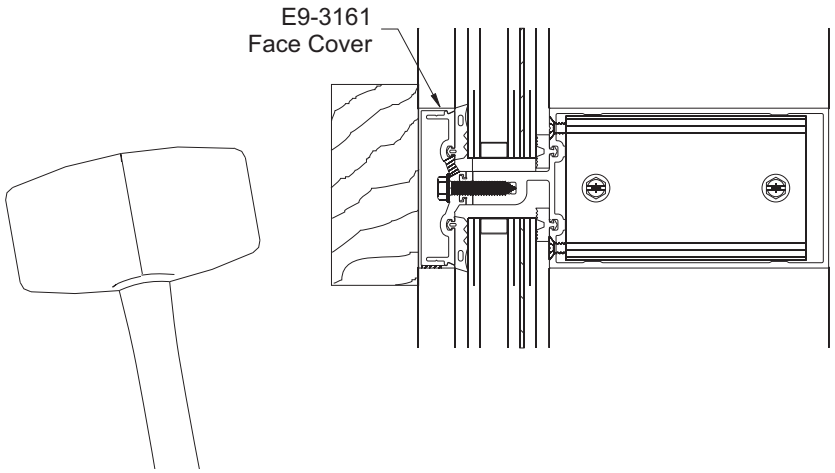
STEP 25
INSTALL EXTERIOR FACE COVERS

-Snap on vertical exterior face covers using a mallet and a clean scrap piece of lumber, starting at the top and working down the vertical.
-Center and install horizontal pressure plates in the opening with HD-2520-W3 fasteners, leaving a 1/8” gap at the ends. Initially torque the fasteners to 50 inch-pounds; then tighten all of them to 75 inch-pounds.
-Apply and tool sealant to completely seal the gaps at horizontal pressure plate ends.
-Snap on horizontal face covers, starting at one end and working block and mallet across the horizontal.

See **Detail 47**.



DETAIL 47
Insulating Glazing Shown
Single Glazing Similar



GLAZING

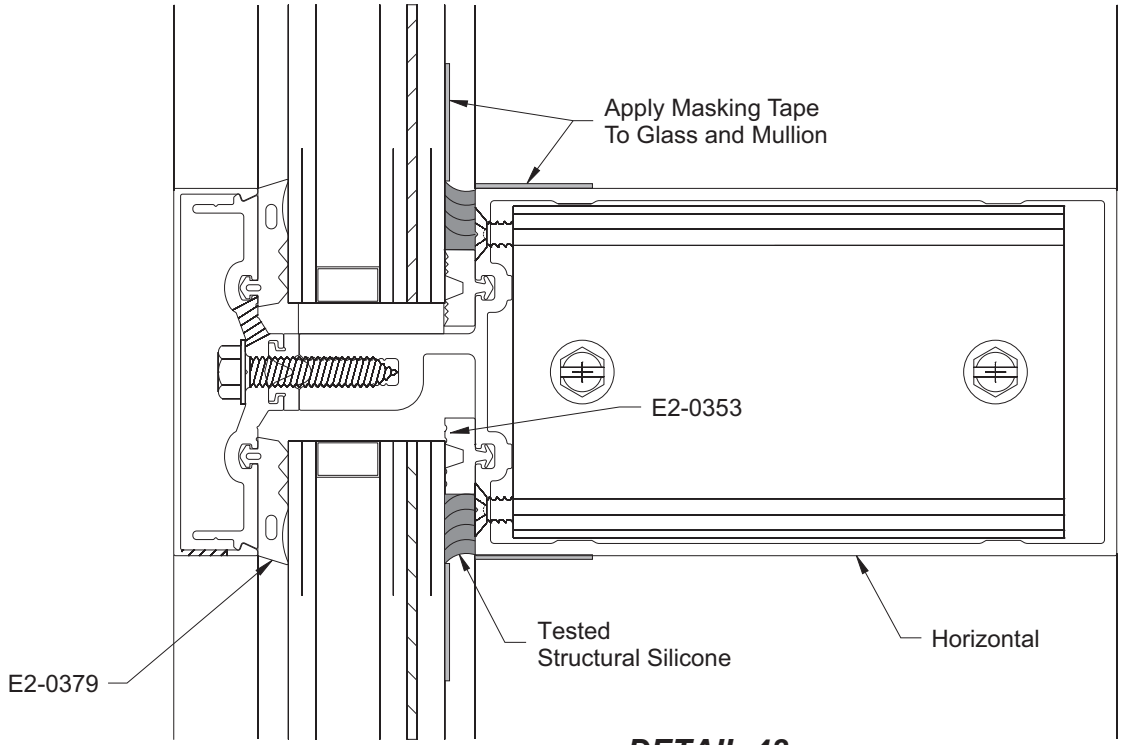
STEP 26
APPLY INTERIOR SILICONE SEALANT

-Make sure all silicone contact surfaces and joints have been cleaned with a cleaner and method as approved by sealant manufacturer.
-Apply masking tape to the mullion and glass as shown in **Detail 48**.
-Apply tested structural silicone sealant into the cavity between the mullion and glass starting from the bottom and work towards the top. Use positive pressure so that the silicone sealant completely fills the cavity.
-Using a nylon spatula or other non-scratching implement, tool the silicone sealant immediately after running the joint. Exert positive pressure while tooling to ensure that the silicone sealant makes complete contact with all surfaces.

Caution: Be careful not to remove too much silicone sealant.

-Remove masking tape immediately after tooling and before silicone skins over.

Caution: Do not permit the silicone sealant to skin over before it is tooled. Immediately remove masking tape after tooling silicone sealant.



DETAIL 48
Insulating Glazing Shown
Single Glazing Similar

YKK AP America Inc.

270 Riverside Parkway,
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Austell, Georgia 30168
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CSI MASTERFORMAT SECTION NUMBER **08 44 13**
CSI MASTERFORMAT SECTION TITLE **GLAZED ALUMINUM CURTAIN WALL**
YKK AP PRODUCT SERIES **YKK AP YHC 300 OG SERIES**

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Aluminum Curtain Wall Systems:
   1. YKK AP Series YHC 300 OG (Outside Glazed) Impact Resistant Aluminum Curtain Wall System.
B. Related Sections:
   1. Sealants: Dow Corning® 995 Structural Silicone Sealant.
   2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
   3. Single Source Requirement: All products listed below shall be by the same manufacturer.
      a. Section 08 32 13 Sliding Aluminum - Framed Glass Doors.
      b. Section 08 41 13 Aluminum - Framed Entrances and Storefronts.
      c. Section 08 51 13 Aluminum Windows.
      d. Section 08 44 33 Sloped Glazing Assemblies.

1.02 SYSTEM PERFORMANCE DESCRIPTION

A. All test unit sizes and configurations shall conform to the minimum sizes in accordance with; Florida High Velocity Hurricane Zone (HVHZ) Protocols, ASTM E 1886, ASTM E 1996, and meet all requirements of TAS 201, TAS 202, and TAS 203. They shall also comply with the following specific performance requirements indicated.
   1. Air Infiltration: Completed curtain wall systems shall have 0.06 CFM/FT² (1.10 m³/h·m²) maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF (299 Pa).
   2. Water Infiltration: No uncontrolled water, other than condensation, on indoor face of any component when tested in accordance with ASTM E 331 at test pressure differential of 20 PSF (958 Pa). Water test to be performed immediately after design pressure test.
   3. Wind Loads: Completed curtain wall system shall withstand wind pressure loads normal to wall plane indicated:
      a. Structural Performance:
         1) Positive Pressure: ___ psf.
         2) Negative Pressure: ___ psf.
   4. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures:
      a. Without Horizontals: L/175 or 3/4" (19.1mm) maximum.
      b. With Horizontals: L/175 or L/240 + 1/4" (6.4mm) for spans greater than 13'-6" (4.1m) but less than 40'-0" (12.2m).
   5. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.
   6. Thermal Performance: When tested in accordance with AAMA 1503.1 and NFRC 102:
      a. Condensation Resistance Factor (CRF_f): A minimum of 72.
      b. Thermal Transmittance U Value: .42 BTU/HR/FT²/ºF or less.
      Note: The CRF for the glazed system as a whole will be affected by the characteristics of the glass specified.
   7. Acoustical Performance: Acoustical Performance: When tested in accordance with ASTM E 1425:
      a. Sound Transmission Class (STC) shall not be less than 37.
      b. Outdoor–Indoor Transmission Class (OITC) shall not be less than 32.

1.03 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."
B. Product Data: Submit product data for each type curtain wall series specified.
C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.
E. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.
F. Quality Assurance / Control Submittals:

1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
2. Installer Qualification Data: Submit installer qualification data.

G. Closeout Submittals:
1. Warranty: Submit warranty documents specified herein.
2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.

1.04 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.

B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, and workmanship standard.
1. Mock-Up Size:
2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.05 PROJECT CONDITIONS / SITE CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.06 WARRANTY

A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.
1. Warranty Period: Manufacturer’s one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.

EDITOR NOTE: Longer warranty periods are available at additional cost.

PART 2 PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

A. Acceptable Manufacturers: YKK AP America Inc.
270 Riverside Parkway, Suite 100
Austell, GA 30168
Telephone: (678) 838-6000; Fax: (678) 838-6001
1. Curtain Wall System: YKK AP YHC 300 OG Curtain Wall System.

B. Curtain Wall Framing System:
1. Description: Framing System shall be thermally improved. Horizontal and vertical members shall have a nominal face dimension of 3 inches, depth as indicated on the shop drawings. Framing system shall provide a flush glazed appearance on all sides with no protruding glass stops.
2. Glazing: Manufacturer's standard silicone compatible EPDM glazing gaskets to inhibit water infiltration at the exterior and Dow Corning® 995 Structural Silicone Sealant with fixed stops at the interior; interior spacers are to be silicone.

2.02 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:

1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.
2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95 mm) minimum thickness.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:
   1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel fasteners. Joint fasteners may be concealed.
   2. Sealant: Non-skinning type, AAMA 803.3
   3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; exterior glazing silicone compatible EPDM gaskets, in accordance with ASTM C 864, designed to lock into gasket reglet, interior by means of silicone spacer and structural silicone adhesive.
   4. Glazing Adhesive: Dow Corning® 995 Structural Silicone.

2.04 RELATED MATERIALS (Specified In Other Sections)

A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.05 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
   1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
   2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.06 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE	DESCRIPTION
YS1N*	Clear Anodized Plus®
YH3N	Champagne Anodized Plus®
YB1N	Medium Bronze Anodized Plus®
YB5N*	Dark Bronze Anodized Plus®
YK1N*	Black Anodized Plus®
YW3N	White Anodized Plus®
M	Mill Finish

* Indicates standard finish usually carried as inventory.

Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability (See AAMA 612).

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:
   1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
      a. Exposed Surfaces shall be free of scratches and other serious blemishes.
      b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
      c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
      d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. High Performance Organic Coating Finish:
   1. Type Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP procedures and meeting AAMA 2605 specifications.
   2. Colors: Selected by Architect from the following:
      a. Standard coating color charts.
      b. Custom coating color charts.
      c. Color Name and Number:

D. Finishes Testing:
   1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.
   2. Submit samples with test area noted on each sample.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest Installation Manual can be found at www.ykkap.com.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
   1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
   2. Shim and brace aluminum system before anchoring to structure.
   3. Verify curtain wall system allows water entering system to be collected in gutters and wept to exterior. Verify weep holes are open, and metal joints are sealed in accordance with manufacturers installation instructions.
   4. Seal metal to metal curtain wall system joints using sealant recommended by system manufacturer.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.
B. Field Test: Conduct field test to determine watertightness of curtain wall system. Conduct test in accordance with AAMA 501.2.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.
B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to owner's acceptance, and remove construction debris from project site. Legally dispose of debris.
C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

04-3009-04

This document supersedes all previous versions.

YFW 400 TUH

YFW 400 TUH

Thermally Broken, Impact Resistant and Blast Mitigating Fixed Window

ProTek

ProTek®

YKK AP Hurricane & Blast Solutions

Integrated Superior Protection

The YFW 400 TUH ProTek® thermally broken impact resistant and blast mitigating fixed windows have been designed and engineered to the highest of standards. The quality 4" frame depth fixed window is universal to our 4" depth impact resistant operable window systems. This fixed window system will easily integrate with our YVS 410 TUH Single Hung window system utilizing the same stacking mullions. Integral horizontal and vertical mullions provide greatly expanded configurations.

Superior air and water performance enhance this factory glazed product making it an excellent substitution for smaller storefront punched openings.

The YFW 400 TUH is a high performance window that is designed for the high velocity winds of south Florida. Additional benefit is provided by the labor savings when used as a factory glazed fixed window.

This window system not only provides additional security against burglary but also the minimal hazard level of ASTM F 1642 for blast mitigation.

YKK AP® Quality inspires®

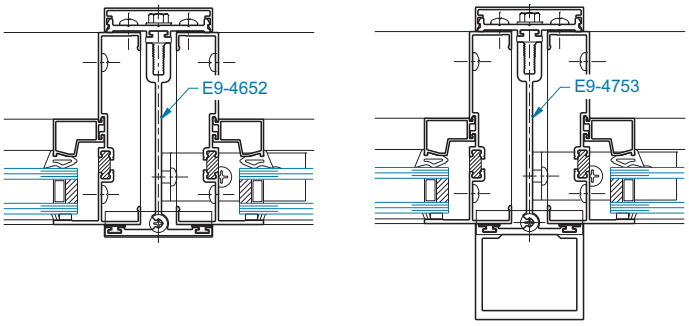
YFW 400 TUH

SYSTEM SPECIFICATIONS

System Sightline	Base Depth	Glazing & Config	Glass	Air Infiltration	Water Infiltration	Thermal Performance	Acoustical Performance
2”	4”	Laminated Pre-Glazed & Fixed	1” IGU with Low-E (C.O.G. U-factor: 0.29)	0.30 CFM/FT² (16.5 m³/h·m²)	**Static:** 15 PSF (719 Pa)	**U-factor:** 0.40 BTU/HR•FT²•°F* **CRF:** Minimum of 67 on frame**	**Lam STC:** 38 **Lam OITC:** 30
Testing Standards				ASTM E 283	ASTM E 331 & AAMA 501	* NFRC 102 & ** AAMA 1503	ASTM E 90 & 1425

Florida Product Approval	Large and Small Missle, HVHZ, ICC Compliant, AW Performance Grade 100 for Fixed Window
Available Finishes	Factory Anodized (AAMA 612) and Organic Paints (AAMA 2605)

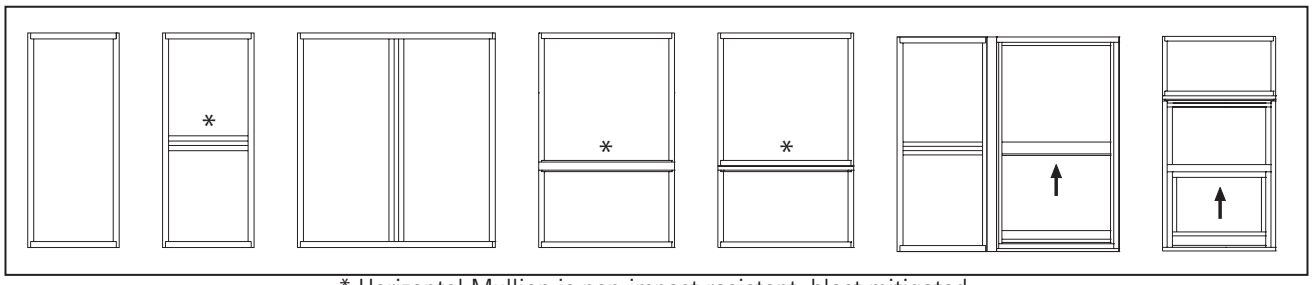
MULLION OPTIONS



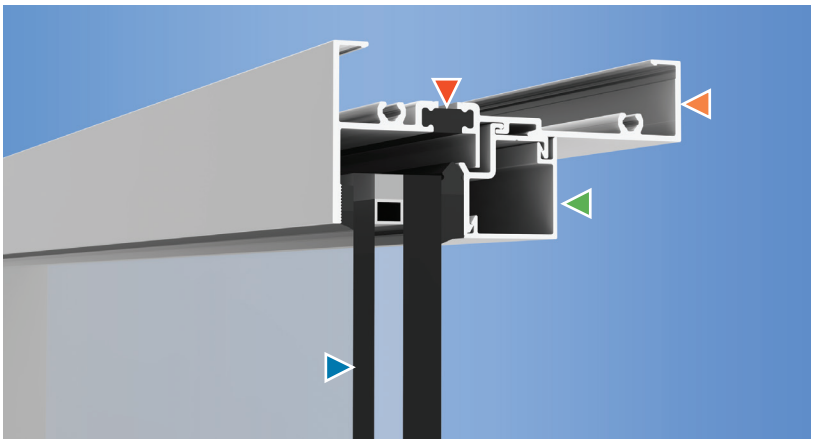
FEATURES & BENEFITS

- Certified AAMA Performance Grade: AW-PG100-FW
- ThermaBond Plus® Thermal Break
- 1” Insulating Glazing or Insulating Panels
- Vertical and Horizontal Stacking Mullion Options
- Box Trim, Sill Flashing, Panning, and Multiple Anchor Options
- Large Missile is Wet Glazed, Small is Dry Glazed
- ASTM E 1886/1996, TAS 201, 202, & 203
  - Meets ICC Requirements, Florida State-Wide Approval – High Velocity Hurricane Zone (HVHZ)
  - Tested to +90psf/ –120psf
- Blast Mitigation; “Minimal Hazard” per ASTM F 1642 Test @ 6psi / 41 psi-ms

CONFIGURATIONS & FEATURES



* Horizontal Mullion is non-impact resistant, blast mitigated.



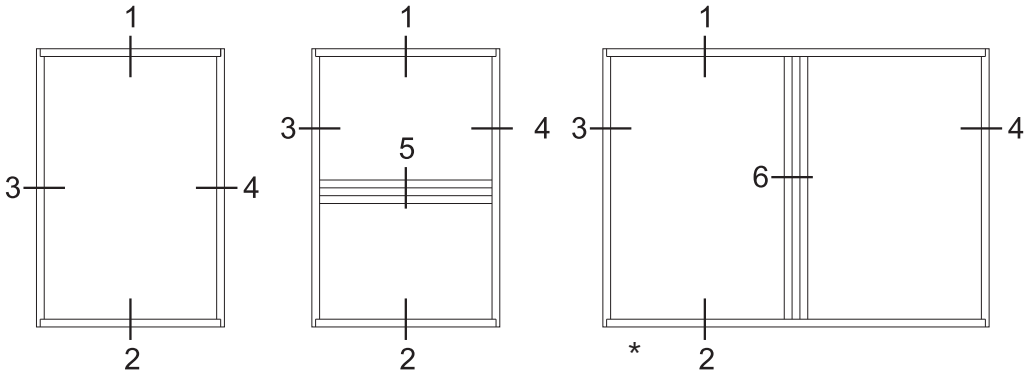
YFW 400 TUH Design Features

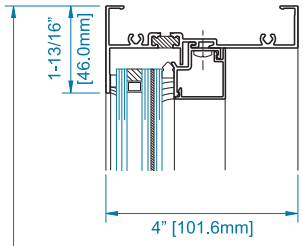
- Equal Legs on Frame for Easy Installation in New Construction or Renovations
- Interlocking Mechanically Fastened Aluminum Bead Glazing (LMI Wet/SM Dry)
- ThermaBond Plus® Thermal Break for Superior Thermal Performance
- 1” Glazing – IGU’s or Insulating Panels

Additional information including CAD details, CSI specifications, Test Reports and Installation instructions are available online at:
www.ykkap.com/commercial/product/architectural-windows/yfw-400-tuh/

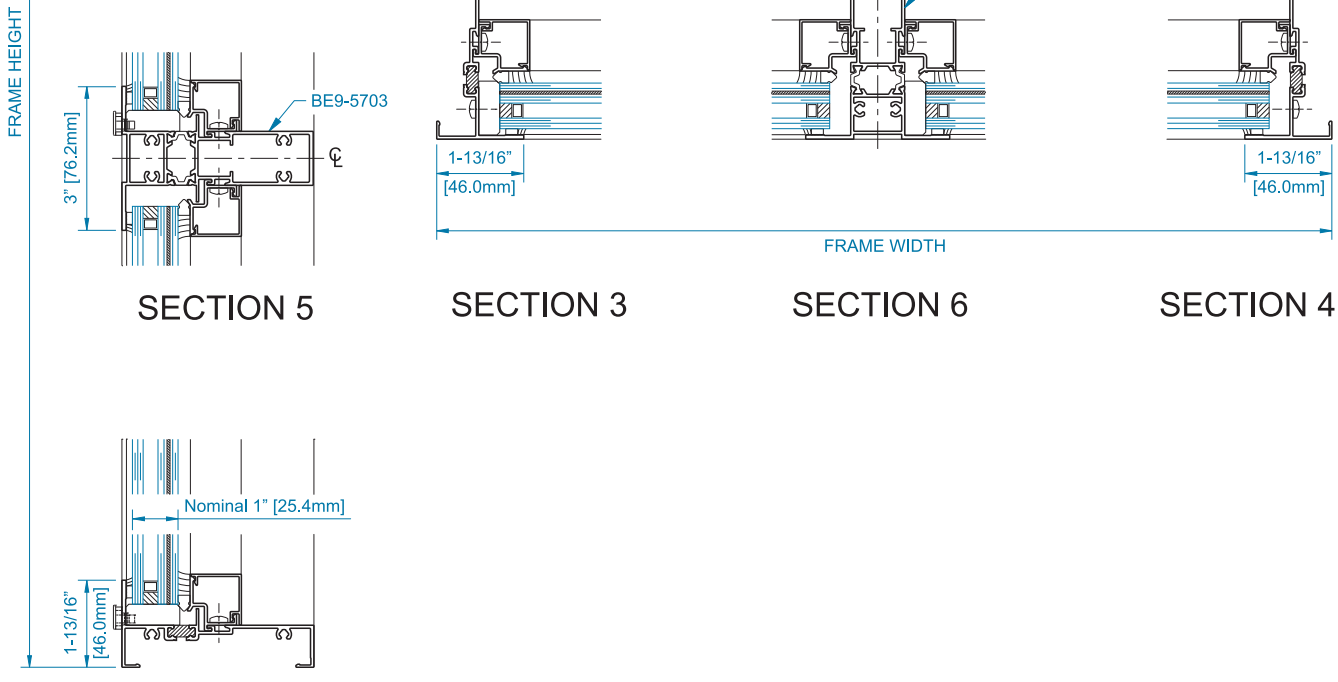
270 Riverside Pkwy, Suite 100, Austell, GA 30168 Tel: 678-838-6000

YFW 400 TUH FIXED





SECTION 1



SECTION 5 SECTION 3 SECTION 6 SECTION 4

SECTION 2

SCALE: 1/4 SIZE

0 3 6

* NOTE: Use of integral and stacking mullions approved only for standard and blast mitigation.

1.0 MANUFACTURER'S IDENTIFICATION

1.1 Name of Applicant: YKK AP America, Inc.
332 Firetower Road
Dublin, Georgia 31021
(478) 277-2549
Fax (478) 277-2545

1.2 Contact Person: Masanori Moriya

2.0 LABORATORY IDENTIFICATION

2.1 HTL Lab Certifications: Miami-Dade County (04-0806.02)
Florida Building Code (TST3892)
IAS (TL-338)

2.2 Miami-Dade Test Notification #: HTLGA0922

3.0 SCOPE OF WORK

3.1 Introduction

YKK AP America, Inc. retained HTL Georgia to conduct testing of their YFW-400-TUH Window system per the requirements of the Florida building Code (HVHZ) TAS 201, 202, 203, ASTM E283, E330, E331, E1886, and E1996.

3.2 Report Information

Table 3.1 provides the test dates and ratings for the units tested.

Table 3.1: Report Summary

YKK designation	Specimen #	Test Date	Performance Class
YFW-400-TUH-01	1A	07/01/09 - 07/09/09	+90/-120 psf
	1B	07/08/09 - 07/09/09	
	1D	07/09/09 - 07/10/09	

4.0 PRODUCT IDENTIFICATION

4.1 Product Type: Fixed Window

4.2 Model Designation: YFW-400-TUH-01-Large

4.3 Overall Size: 52" (w) x 96" (h)

4.4 Drawing: This test report is incomplete if not accompanied by YKK AP America, Inc. drawings labeled "YFW400TUH-01, thru -09 " (sheets 1-9) with bearing the ink stamp of Hurricane Test Laboratory, LLC.

4.5 Sample Source: Sample provided by YKK AP America, Inc..

4.6 Additional Information:

4.6.1 Glazing Details:

4.6.1.1 Glazing:

Table 4.2 describes the type of glass used for testing.

Table 4.2: Glazing Schedule

Glass Type	Overall Thickness	Makeup
1	1"	3/16" heat strengthened glass (inboard) 0.075" Vanceva Interlayer 3/16" heat strengthened glass 5/16" air space 1/4" heat strengthened glass (outboard)

4.6.1.2 Glazing Method:
Table 4.3 describes the glazing methods used for this test unit.

Table 4.3 Glazing Details

Glass Type	Qty.	DLO	Glass Bite	Glazing Method	
				Interior	Exterior
1	1	48-3/8" (w) x 92-3/8" (h)	1/2"	TREMCO Pro Glaze 2 Structural Silicone Sealant and Arrow Spacer (Part # E2-0359)	Glazing Tape PSA-2 (Part # E2-0670) and a cap bead of TREMCO Tremsil 600 Silicone Sealant

4.6.2 Installation:
Table 4.7 describes the anchors used to install the test units into the test frame.

Table 4.7: Installation

Location	Substrate	Description	Spacing
Head, Jambs, & Sill	Wood	# ¼" x 2-1/4" Tapcons using a Strap Anchor (Part # E1-1921)	4" from the ends and 11" o.c. thereafter

5.0 TEST RESULTS

5.1 Summary of Results
Table 5.1 summarizes the test results for this test specimen.

Table 5.1: Summary of Results

Specimen	Test Method	Test Conditions	Result
1A	Air Infiltration Test (TAS 202 and ASTM E283)	1.57 & 6.24 psf	PASS
1A	Water Infiltration Test (TAS 202 and ASTM E331)	15 psf	PASS
1A	Uniform Static Load Test (TAS 202 and ASTM E330)	+90/-120 psf Design Pressure	PASS
1A, 1B, 1D	Large Missile Impact Test (TAS 201 and ASTM E1886/E1996)	9-lb., 96-in. wood 2 x 4 (ASTM E1996 – Level D)	PASS
1A, 1B, 1D	Cyclic Load test (TAS 203 and ASTM E1886/E1996)	+90/- 120 psf Design Pressure	PASS

5.2 Air Infiltration Test

5.2.1 Results – Air Infiltration Test

Table 8.1 provides the test results of the air infiltration test.

Table 8.1: Air Infiltration Test Results

Specimen #	Test Pressure (psf)	Measured (cfm/ft^2)	Allowed (cfm/ft^2)
1A	+1.57	0.010	0.30
	+6.24	0.008	N/A

5.2.2 Conclusion – Air Infiltration Test

HTL observed a measured air infiltration less than the allowed air infiltration through the test specimen; as such, this test specimen satisfies the requirements of ASTM E283-04.

5.3 Water Infiltration Test

5.3.1 Results – Water Infiltration Test

Table 8.2 provides the results for the water infiltration test per the requirements of STM E331-00.

Table 8.2: Water Infiltration Test Results

Specimen #	Test Pressure (psf)	Spray Rate (gph/ft^2)	Test Duration (minutes)	Conclusion
1A	15	5	15	Pass

5.3.2 Conclusion – Water Infiltration Test

HTL observed zero (0) water infiltration through the test specimen; as such, this test specimen satisfies the requirements of TAS 202- ASTM E331- ASTM E547.

5.4 Uniform Static Load Test

5.4.1 Deflection Gage Locations

Figure 5.3 shows the deflection gage locations for the uniform static load test.

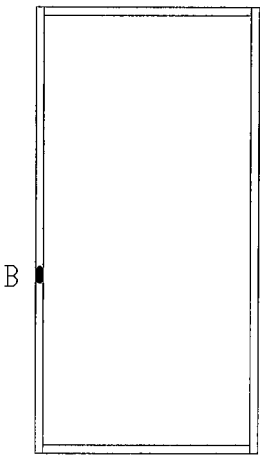


Figure 5.3: Deflection Gage Locations for the Uniform Static Load Test (longest fastener span)

5.4.2 Positive Load Test Results

Table 5.3.1 provides the positive uniform static load test results for the deflection gage location shown in Figure 5.3.

Table 5.3.1: Positive Uniform Static Load Test Results

Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)		Recovery (%)	
		Measured	Allowed	Measured	Allowed	Measured	Allowed
B	+67.5	0.029	N/A	0.001	0.048	96.55	90
	+90.0	0.053		0.001		99.06	90
	+135	0.067		.001		99.25	80

5.4.3 Negative Uniform Static Load Test Results

Table 5.3.2 provides the negative uniform static load test results for the locations presented in Figure 5.3.

Table 5.3.2: Negative Uniform Static Load Test Results

Gage Location	Load (psf)	Deflection (in.)		Permanent Set (in.)		Recovery (%)	
		Measured	Allowed	Measured	Allowed	Measured	Allowed
B	-90.0	0.020	N/A	0.001	0.048	94.87	90
	-120.0	0.025		0.002		92.00	90
	-180.0	0.071		0.008		89.36	80

5.4.3.1 Conclusion – Uniform Static Load Test

HTL observed no signs of failure in any area of this test specimen during the uniform static load test. In addition, the specimen met the deflection and percent recovery requirements; as such, this test specimen satisfies the uniform static load test requirements of ASTM E330 and TAS 202.

5.5 Large Missile Impact Test

5.5.1 Large Missile Impact Locations

Figures 5.5 & 5.6 show the impact location for the specimens tested.

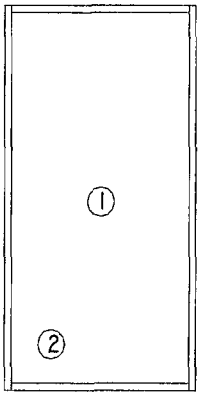


Figure 5.5: Large Missile Impact Locations Specimen 1A

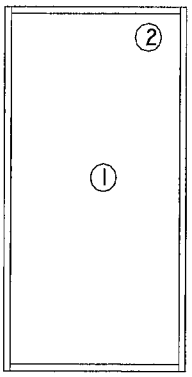


Figure 5.6: Large Missile Impact Locations Specimen 1B, 1D

5.5.2 Test Results – Large Missile Impact Test

Table 5.5 provides the large missile impact test results.

Table 5.5: Large Missile Impact Test Results

Specimen	Impact #	Missile Type	Missile Velocity (ft/sec)	X Coord. (in.)	Y Coord. (in.)
1A	1	LARGE	49.80	26.50	47.00
	2		49.73	13.00	11.50
1B	1		49.85	28.50	51.00
	2		49.98	41.25	88.00
1D	1		49.29	22.25	41.50
	2		49.38	43.00	84.00

5.5.3 Conclusion – Large Missile Impact Test

The large missiles impacted the intended targets and HTL carefully inspected each impact location. HTL observed no signs of penetration, rupture, or opening after the large missile impact test; as such, this test specimen satisfies the large missile requirements of the Florida Building Code TAS 201 and ASTM E1886/E1996.

5.6 Cyclic Load Test

5.6.1 Deflection Gage Locations - Cyclic Load Test

Figure 5.3 shows the deflection gage locations used in the cyclic load test.

5.6.2 Test Spectrum - Cyclic Load Test

Tables 5.5.1 and 5.5.2 provide the positive and negative test spectrum respectively.

Table 5.5.1: Positive Load Test Spectrum

Stage	1	2	3	4
Pressure Range (psf)	18 – 45	0 - 54	45 - 72	27 - 90
Number of Cycles	3500	300	600	100

Table 5.5.2: Negative Load Test Spectrum

Stage	5	6	7	8
Pressure Range (psf)	36 - 120	60 - 96	0 - 72	24 - 60
Number of Cycles	50	1050	50	3350

5.6.3 Deflection Results – Cyclic Load Test

Table 5.5.3 shows the cyclic test results for each test specimen. Deflection gage locations shown on figure 5.3.

Table 5.5.3: Cyclic Load Test Results

Specimen #	Location	Inward (Positive Load)		Outward (Negative Load)	
		Measured Permanent Set (in.)	Permanent Set (in.)	Measured Permanent Set (in.)	Allowable Permanent Set (in.)
1A	B	0.030	.048	0.001	.048
1B		0.000		0.012	
1D		0.010		0.019	

5.6.4 Conclusion - Cyclic Load Test

Upon completion of the cyclic load test, HTL carefully inspected the test specimen for failures. HTL observed no signs of failure; as such, this test specimen satisfies the cyclic load test requirements of Florida Building Code TAS 203 and ASTM E1996.

6.0 CERTIFICATION AND DISCLAIMER STATEMENT

All tests performed on these test specimens were conducted in accordance with the specifications of the applicable codes, standards and test methods listed below by HTL, LLC. HTL, LLC does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested at HTL. HTL is not owned, operated or controlled by any company manufacturing or distributing products it tests. This report is only intended for the use of the entity named in Section 1.0 of this report. Detailed assembly drawings showing wall thickness of all members, corner construction and hardware applications are on file and have been compared to the test specimens submitted. A copy of this test report along with representative sections of the test specimen will be retained at HTL for a period of ten (10) years. All results obtained apply only to the specimens tested and they do indicate compliance with the performance requirements of the test methods and specifications listed in the following section.

7.0 APPLICABLE CODES, STANDARDS, AND TEST METHODS

Florida Building Code TAS 201-94 – Impact Test Procedures

Florida Building Code TAS 202-94 – Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components using Uniform Static Air Pressure

Florida Building Code TAS 203-94 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading

ASTM E283-04 – Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E330-02 -Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

ASTM E331-00 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

ASTM E1886-05 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

ASTM E1996-08e2 –Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

8.0 WITNESSES (ALL OR PARTIAL)

Vinu J. Abraham, P.E.	CEO	HTL, LLC
José E. Colón, E.I.	Operations Manager	HTL, Georgia
Ian McKenzie	Lab Supervisor	HTL, Georgia
Kevin Gardner	Test Team	HTL, Georgia
John Uhl		YKK AP America, Inc.

CONFIDENTIAL

1.0 MANUFACTURER'S IDENTIFICATION

1.1	Name of Applicant:	YKK AP America, Inc. 332 Firetower Road Dublin, Georgia 31021 (478) 277-2549 Fax (478) 277-2545
1.2	Contact Person:	Masanori Moriya

2.0 LABORATORY IDENTIFICATION

2.1	HTL Lab Certifications:	Miami-Dade County (04-0806.02) Florida Building Code (TST3892) IAS (TL-338)
2.2	Miami-Dade Test Notification #:	HTLGA0922

3.0 SCOPE OF WORK

3.1 Introduction

YKK AP America, Inc. retained HTL Georgia to conduct testing of their YFW-400-TUH Window system per the requirements of the Florida building Code (HVHZ) TAS 201, 202, 203, ASTM E283, E330, E331, E1886, and E1996.

3.2 Report Information

Table 3.1 provides the test dates and ratings for the units tested.

Table 3.1: Report Summary

YKK designation	Specimen #	Test Date	Performance Class
YFW-400-TUH-01	1A	07/01/09 - 07/09/09	+90/-120 psf

4.0 PRODUCT IDENTIFICATION

4.1	Product Type:	Fixed Window
4.2	Model Designation:	YFW-400-TUH-01-Large
4.3	Overall Size:	52" (w) x 96" (h)
4.4	Drawing:	This test report is incomplete if not accompanied by YKK AP America, Inc. drawings labeled "YFW400TUH-01, thru -09 " (sheets 1-9) with bearing the ink stamp of Hurricane Test Laboratory, LLC.
4.5	Sample Source:	Sample provided by YKK AP America, Inc..

5.0 TEST RESULTS

5.1 Table 5.1 provides the test results for Specimen #1A

REPORT WRITER

José E. Colón E.I.
HTL Georgia

ENGINEER OF RECORD

Vinu J. Abraham, P.E.
FL Reg. #53820
7/21/2009

Table 5.1: Test Results

Test Method	Test Conditions	Measured	Allowed
Water Infiltration Test (ASTM E331)	20 psf	PASSED per ASTM E331 (no water found inside of the unit)	

6.0 CERTIFICATION AND DISCLAIMER STATEMENT

All tests performed on this test specimen were conducted in accordance with the specifications of the applicable codes, standards and test methods listed below by HTL, LLC. HTL, LLC does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested at HTL. HTL is not owned, operated or controlled by any company manufacturing or distributing products it ests. This report is only intended for the use of the entity named in Section 1.0 of this report. Detailed assembly drawings showing wall thickness of all members, corner construction and hardware applications are on file and have been compared to the test specimen submitted. A copy of this test report along with representative sections of the test specimen will be retained at HTL for a period of ten (10) years. All results obtained apply only to the specimen tested and they do indicate compliance with the performance requirements of the test methods and specifications listed in the following section.

7.0 APPLICABLE CODES, STANDARDS, AND TEST METHODS

ASTM E331-00 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

8.0 WITNESSES

Vinu J. Abraham, P.E.	CEO	HTL, LLC
Jose Colon, E.I.	Operations Manager	HTL Georgia
Ian McKenzie	Laboratory Foreman	HTL Georgia
Kevin Gardner	Test Team	HTL Georgia
John Uhl	Design Engineer	YKK AP America, Inc

FLORIDA | GEORGIA | TEXAS

GEORGIA OFFICE
1701 Westfork Drive, Suite 106
Lithia Springs, Georgia 30122
HTLTEST.COM
P: 888.477.2454
F: 770.941.2930

November 23, 2009

Mr. John Uhl
YKK AP America, Inc.
7680 The Bluffs, Suite 100
Austell, Georgia 30168

Re: Addendum to HTL Test Report # G231-0501-09-1 and G231-0603-09

Dear Mr. Uhl;

The reports issued for the above mentioned job numbers were for YKK's YFW-400TU and YFW-400TUH window systems. In these reports HTL failed to report that the windows were tested to ASTM F588-04. This was an error in our part; please accept the following table as an addendum to the issued test reports:

HTL Job #	Test Method	Result
G231-0501-09-1	Forced Entry Resistance Test (ASTM F588-04)	PASS
G231-0603-09		PASS

These fixed windows were tested to the disassembly and sash manipulation requirements of ASTM F588 and the technicians failed to gain entry through the window.

If you have any further questions regarding the above mentioned tests that were conducted, please contact out office.

Sincerely,

HURRICANE TEST LABORATORY, LLC

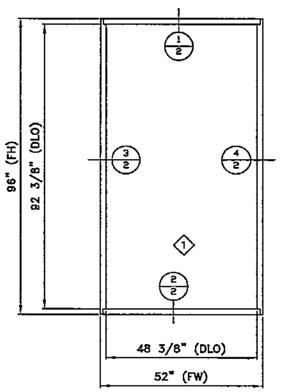
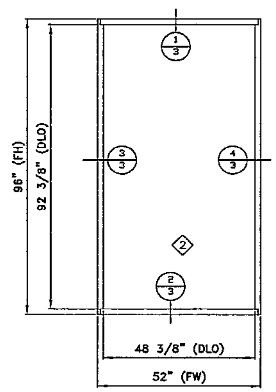
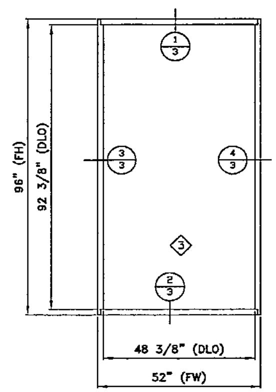
José E. Colón, E.I.
Operations Manager

ENGINEER OF RECORD

Vinu J. Abraham, P.E.
FL Reg. # 53820

YFW400TUH FIXED WINDOW

FPA HVHZ / ASTM E-1996 AND DADE COUNTY, FL. LARGE MISSILE TESTING PROGRAM

TEST SPECIMEN #	YFW400TH-01	YFW400TH-02	YFW400TH-05
ELEVATION			
DESIGN PRESSURE	+90/-120	+90/-120	+90/-120
GLAZING	EXT.: CAP BEADING W/BACKER TAPE INT.: PROGLAZE 2 STRUCTURAL SILICONE	EXT.: CAP BEADING W/BACKER TAPE INT.: DOW 995 STRUCTURAL SILICONE	EXT.: CAP BEADING W/BACKER TAPE INT.: TREMCO SPECTREM 2 STRUCTURAL SILICONE
GLASS	SEE GLAZING OPTIONS CHART	SEE GLAZING OPTIONS CHART	SEE GLAZING OPTIONS CHART
TESTS TO BE PERFORMED	FPA HVHZ/ASTM E-1996 AND DADE COUNTY	FPA HVHZ/ASTM E-1996 AND DADE COUNTY	FPA HVHZ/ASTM E-1996 AND DADE COUNTY
ANCHOR METHOD	STRAP ANCHOR	ANCHOR CLIP	ANCHOR CLIP

GENERAL NOTES

1. THIS PRODUCT HAS BEEN EVALUATED AND IS IN COMPLIANCE WITH THE 2007 FLORIDA BUILDING CODE (FBC) STRUCTURAL REQUIREMENTS INCLUDING THE "HIGH VELOCITY HURRICANE ZONE" (HVHZ).
2. PRODUCT ANCHORS SHALL BE AS LISTED, SPACED AS SHOWN ON DETAILS, ANCHORS EMBEDMENT TO BASE MATERIAL SHALL BE BEYOND WALLDRESSING OR STUCCO.
3. WHEN USED IN THE "HVHZ" THIS PRODUCT COMPLIES WITH SECTION 1626 OF THE FLORIDA BUILDING CODE AND DOES NOT REQUIRE AN IMPACT RESISTANT COVERING.
4. WHEN USED IN AREAS OUTSIDE OF THE "HVHZ" REQUIRING WIND BORNE DEBRIS PROTECTION THIS PRODUCT COMPLIES WITH SECTION 1609.1.2 OF THE 2007 FBC AND DOES NOT REQUIRE AN IMPACT RESISTANT COVERING.
5. SITE CONDITIONS THAT DEVIATE FROM THE DETAILS OF THIS DRAWING REQUIRE FURTHER ENGINEERING ANALYSIS BY A LICENSED ENGINEER OR REGISTERED ARCHITECT.
6. MATERIALS INCLUDING BUT NOT LIMITED TO STEEL/METAL SCREWS, THAT COME INTO CONTACT WITH OTHER DISSIMILAR MATERIALS SHALL MEET THE REQUIREMENTS OF THE 2007 FLORIDA BLDG. CODE, DISSIMILAR MATERIALS, SECTION 2003.8.4

GLASS FORMULAS

FIXED WINDOW (ONE LITE):

GW=(FW-2.625") X GH=(FH-2.625")

GLAZING OPTIONS

LARGE MISSILE IMPACT RESISTANT – 1" INSULATED-LAMINATED

◇1 SPECIMEN YFW400TH-01
INSIDE LITE, 3/16" HS / 0.075 VANCEVA / 3/16" HS-5/16" AIRSPACE-OUTSIDE LITE, 1/4" HS

◇2 SPECIMEN YFW400TH-02
INSIDE LITE, 3/16" HS / 0.090 SAFLEX / 3/16" HS-5/16" AIRSPACE-OUTSIDE LITE, 1/4" HS

◇3 SPECIMEN YFW400TH-05
INSIDE LITE, 3/16" HS / 0.090 SGP / 3/16" HS-5/16" AIRSPACE-OUTSIDE LITE, 1/4" HS

SHUTTERS ARE NOT REQUIRED

DESIGN PRESSURES: +90PSF -120PSF

HTL
Tested Unless Otherwise Noted
DATE 7/21/09
G231-0603-09

TABLE OF CONTENTS

YKK AP AMERICA INC.
HEADQUARTERS:
7880 The Bluffs, Suite 100 PH:(678)838-6000
Austell, GA 30168 FAX:(678)838-6066
DUBLIN PLANT:
352 Firetower Road PH:(478)277-1985
Dublin, GA 31021 FAX:(478)277-2500

NO.	REVISION	DATE	BY
1	ADDED YFW400TH-05 SPECIMEN	4/17/09	JU

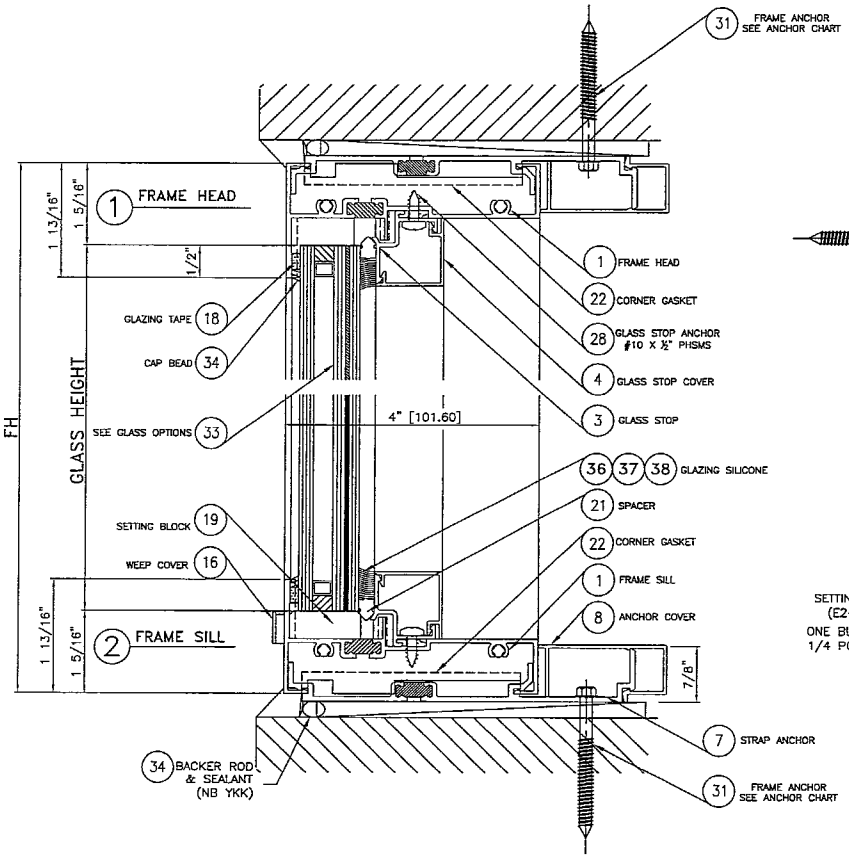
DESCRIPTION: NOTES AND TEST ELEVATIONS FPA HVHZ / ASTM E-1996 DADE COUNTY, FL. LARGE MISSILE TESTING PROGRAM

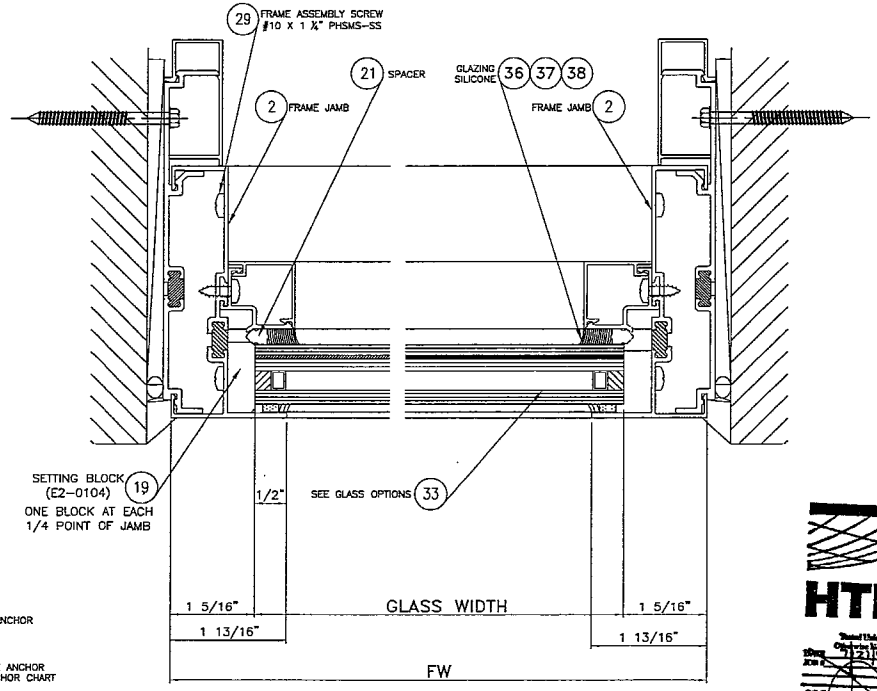
SYSTEM: YFW400TUH FIXED WINDOW SYSTEM

DRAWING NUMBER:	YFW400TUH-01
FINISH:	ANODIZED or PAINT
SCALE: NTS	GLAZING: AS SHOWN
DRAWN BY: J.U.	Rev.: 1
APPROVED BY: M.M.	SHEET NO.: 1
DATE: 04/07/09	

YFW400TUH FIXED WINDOW

FPA HVHZ / ASTM E-1996 AND DADE COUNTY,FL. LARGE MISSILE TESTING PROGRAM-USING STRAP ANCHORS





3 LEFT JAMB

4 RIGHT JAMB

HTL

E23-0603-09

YKK ap

YKK AP AMERICA INC.
HEADQUARTERS: 7680 Tha Blvd, Suite 100 Austell, GA 30168 PH(678)838-6000 FAX(678)838-6056
DUBLIN PLANT: 332 Fireplower Road Dublin, GA 31021 PH(478)277-1955 FAX(478)277-2000

NO.	REVISION	DATE	BY
1	ADDED SPECIMEN YFW400TH-02	4/17/09	JU

DESCRIPTION: CROSS SECTIONS YFW400TUH-01 FPA HVHZ / ASTM E-1996/ DADE COUNTY, FL. LARGE MISSILE TESTING PROGRAM

SYSTEM: YFW400TUH FIXED WINDOW SYSTEM

DRAWING NUMBER: YFW400TUH-02

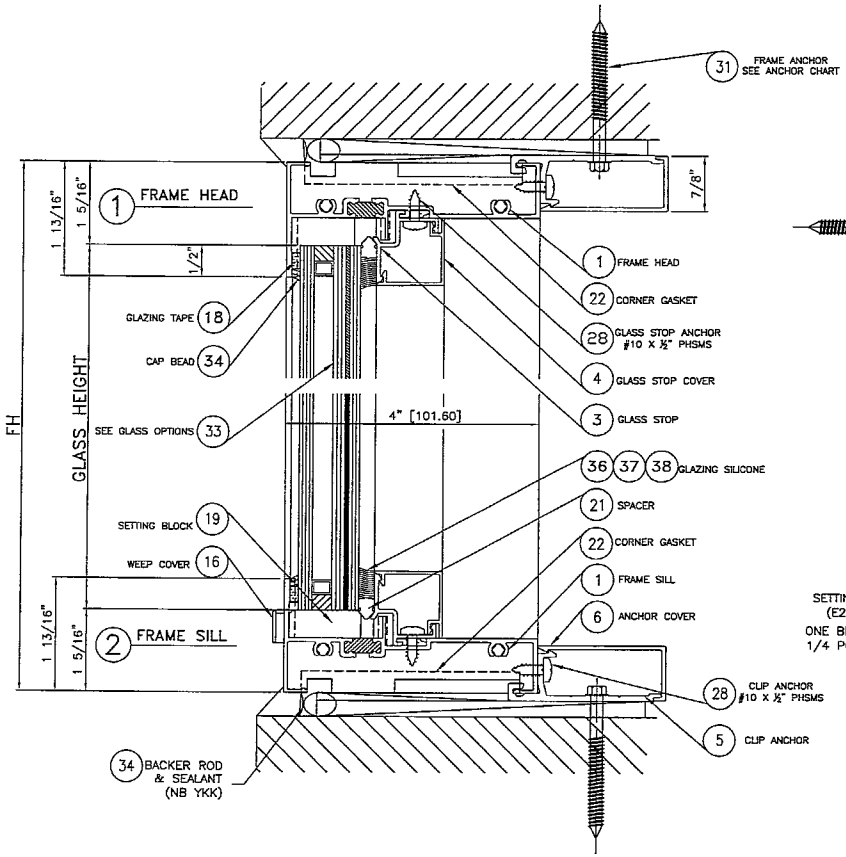
FINISH: ANODIZED or PAINTED

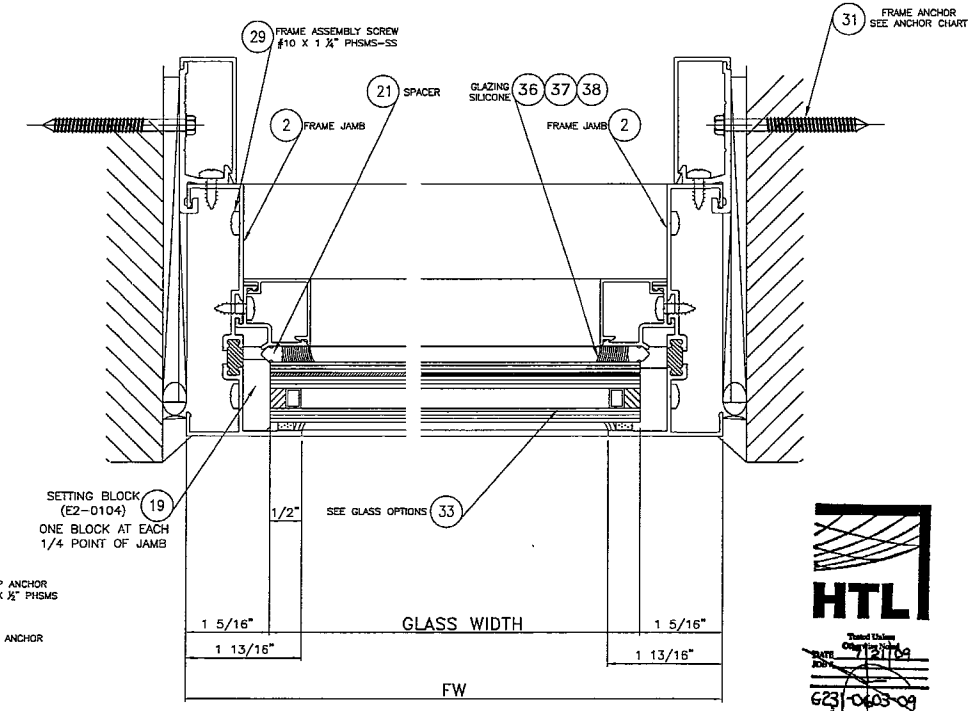
SCALE:	GLAZING:
1/2	AS SHOWN
DRAWN BY: J.U.	Rev.: 1
APPROVED BY: M.M.	SHEET NO.: 2
DATE: 04/07/09	

F:\LIBRARY\YKK\YFW\WINDOWS\YFW400TUH\DRAWINGS\YFW400TUH-02.DWG

YFW400TUH FIXED WINDOW

FPA HVHZ / ASTM E-1996 AND DADE COUNTY, FL. LARGE MISSILE TESTING PROGRAM-USING CLIP ANCHORS





3 LEFT JAMB

4 RIGHT JAMB

HTL
Tested Unless Otherwise Noted
DATE 7/21/09
623-0403-09

YKK AP AMERICA INC.
HEADQUARTERS: 7880 The Bluffs, Suite 100 Austell, GA 30168 PH:(678)838-6000 FAX:(678)838-6056
DUBLIN PLANT: 332 Firetower Road Dublin, GA 31021 PH:(478)277-1955 FAX:(478)277-2500

NO.	REVISION	DATE	BY
1	ADD SPECIMEN YFW400TH-05	4/17/09	JU

DESCRIPTION: CROSS SECTIONS YFW400TUH-02 FPA HVHZ / ASTM E-1996/ DADE COUNTY, FL. LARGE MISSILE TESTING PROGRAM

SYSTEM: YFW400TUH FIXED WINDOW SYSTEM

DRAWING NUMBER: YFW400TUH-03

FINISH: ANODIZED or PAINTED

SCALE: 1/2 | GLAZING: AS SHOWN

DRAWN BY: J.U. | Rev.: 1

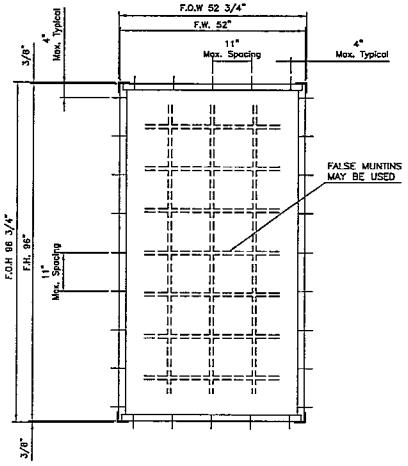
APPROVED BY: M.M. | SHEET NO.: 3

DATE: 04/07/09

F:\LIBRARY\LIBRARY\WINDOWS\YFW400TU\MOCKUP DRAWINGS\IMPACT\YFW400TUH-03.DWG

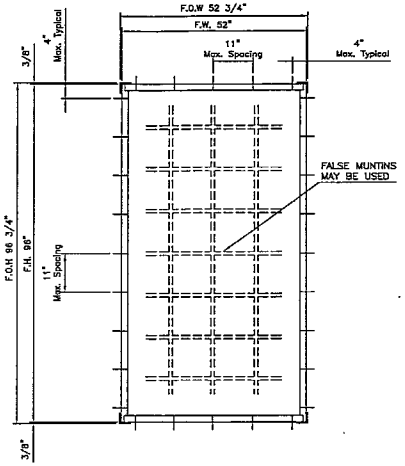
YFW400TUH FIXED WINDOW

FPA HVHZ / ASTM E-1996 and DADE COUNTY, FL. LARGE MISSILE TESTING PROGRAM



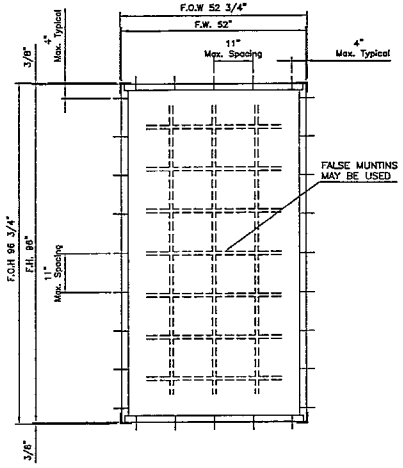
SPECIMEN YFW400TH-01

STRAP ANCHORED TO 2x WOOD BUCK, USING #14 FASTENERS



SPECIMEN YFW400TH-02

CLIP ANCHORED TO 2x WOOD BUCK, USING #14 FASTENERS



SPECIMEN YFW400TH-05

CLIP ANCHORED TO 2x WOOD BUCK, USING #14 FASTENERS

CONSTRUCTION

FRAME CORNER

COPED, SECURED WITH TWO (2) NO. 10 X 1 ¼" SMSSS PER CORNER AND SEALED WITH A RUBBER GASKET BETWEEN HORIZONTAL AND VERTICAL FRAME MEMBERS. ALL VOIDS AND RECESSED JOINTS SHALL BE SEALED WITH TREMCO 600 SEALANT OR EQUAL.

SUBSTRATE REQUIREMENTS:

WOOD: MIN. 2x GRADE 2 SOUTHERN PINE
METAL STUD: MIN. 18 GA. 33 KSI STEEL
STRUCTURAL STEEL: MIN. 12 GA. 36 KSI
CMU: MIN. 1800 PSI
CONCRETE: MIN. 2500 PSI

HTL
Tested Unless Otherwise Noted
DATE: 7/21/09
G23-0608.09

YKK ap

YKK AP AMERICA INC.
HEADQUARTERS: 7800 The Bluffs, Suite 100 Austell, GA 30168 PH:(678)838-6000 FAX:(678)838-6038
DUBLIN PLANT: 332 Flowtower Road Dublin, GA 31021 PH:(478)277-1955 FAX:(478)277-2800

NO.	REVISION	DATE	BY
1	ADD SPECIMEN YFW400TH-05	4/17/09	JU

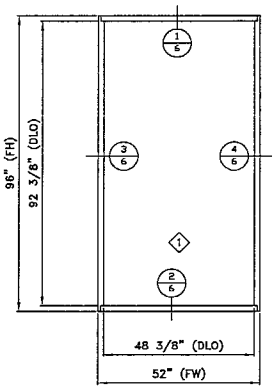
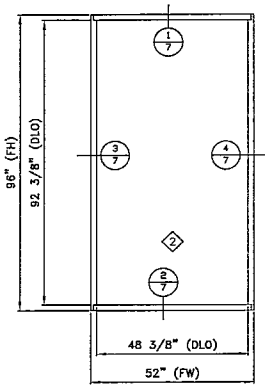
DESCRIPTION: FRAME ANCHORING ELEVATIONS FPA HVHZ / ASTM E-1996/ DADE COUNTY, FL. LARGE MISSILE TESTING PROGRAM

SYSTEM: YFW400TUH FIXED WINDOW SYSTEM

DRAWING NUMBER: YFW400TUH-04
FINISH: ANODIZED or PAINTED
SCALE: NTS
GLAZING: AS SHOWN
DRAWN BY: J.U.
Rev.: 1
APPROVED BY: M.M.
SHEET NO.: 4
DATE: 04/07/09

YFW400TUH FIXED WINDOW

FPA HVHZ / ASTM E-1996 AND DADE COUNTY, FL. SMALL MISSILE TESTING PROGRAM

TEST SPECIMEN #	YFW400TH-03	YFW400TH-04
ELEVATION		
DESIGN PRESSURE	+90/-120	+90/-120
GLAZING	EXT.: CAP BEADING W/BACKER TAPE	EXT.: CAP BEADING W/BACKER TAPE
	INT.: WEDGE GASKET	INT.: WEDGE GASKET
GLASS	SEE GLAZING OPTIONS CHART	SEE GLAZING OPTIONS CHART
TESTS TO BE PERFORMED	FPA HVHZ/ASTM E-1996 AND DADE COUNTY	FPA HVHZ/ASTM E-1996 AND DADE COUNTY
ANCHOR METHOD	STRAP ANCHOR	ANCHOR CLIP

GENERAL NOTES

1. THIS PRODUCT HAS BEEN EVALUATED AND IS IN COMPLIANCE WITH THE 2007 FLORIDA BUILDING CODE (FBC) STRUCTURAL REQUIREMENTS INCLUDING THE "HIGH VELOCITY HURRICANE ZONE" (HVHZ).
2. PRODUCT ANCHORS SHALL BE AS LISTED, SPACED AS SHOWN ON DETAILS, ANCHORS EMBEDMENT TO BASE MATERIAL SHALL BE BEYOND WALLDRESSING OR STUCCO.
3. WHEN USED IN THE "HVHZ" THIS PRODUCT COMPLIES WITH SECTION 1626 OF THE FLORIDA BUILDING CODE AND DOES NOT REQUIRE AN IMPACT RESISTANT COVERING WHEN INSTALLED ABOVE 30 FEET.
4. WHEN USED IN AREAS OUTSIDE OF THE "HVHZ" REQUIRING WIND BORNE DEBRIS PROTECTION THIS PRODUCT COMPLIES WITH SECTION 1609.1.2 OF THE 2007 FBC AND DOES NOT REQUIRE AN IMPACT RESISTANT COVERING.
5. SITE CONDITIONS THAT DEVIATE FROM THE DETAILS OF THIS DRAWING REQUIRE FURTHER ENGINEERING ANALYSIS BY A LICENSED ENGINEER OR REGISTERED ARCHITECT.
6. MATERIALS INCLUDING BUT NOT LIMITED TO STEEL/METAL SCREWS, THAT COME INTO CONTACT WITH OTHER DISSIMILAR MATERIALS SHALL MEET THE REQUIREMENTS OF THE 2007 FLORIDA BLDG. CODE, DISSIMILAR MATERIALS, SECTION 2003.8.4

GLASS FORMULAS

FIXED WINDOW (ONE LITE):

GW=(FW-2.625") X GH=(FH-2.625")

GLAZING OPTIONS

SMALL MISSILE IMPACT RESISTANT - 1" INSULATED-LAMINATED

① SPECIMEN YFW400TH-03
INSIDE LITE, 3/16" HS / 0.060 SAFLEX / 3/16" HS-5/16" AIRSPACE-OUTSIDE LITE, 1/4" HS

② SPECIMEN YFW400TH-04
INSIDE LITE, 3/16" HS / 0.060 BUTACITE / 3/16" HS-5/16" AIRSPACE-OUTSIDE LITE, 1/4" HS

SHUTTERS ARE NOT REQUIRED WHEN INSTALLED ABOVE 30 FEET

DESIGN PRESSURES: +90PSF -120PSF

HTL

Tested Unless Otherwise Noted
JOB #
G23I-0613-09

TABLE OF CONTENTS

YKK AP AMERICA INC.
HEADQUARTERS: 7000 The Bluffs, Suite 100 Austell, GA 30168 PH:(678)838-6000 FAX:(678)838-6086
DUBLIN PLANT: 332 Fivelower Road Dublin, GA 31021 PH:(478)277-1955 FAX:(478)277-2500

NO.	REVISION	DATE	BY
1	ADD BREAKER YFW400TH-05	4/17/09	JU

DESCRIPTION: NOTES AND TEST ELEVATIONS FPA HVHZ / ASTM E-1996/ DADE COUNTY, FL. SMALL MISSILE TESTING PROGRAM

SYSTEM: YFW400TUH FIXED WINDOW SYSTEM

DRAWING NUMBER: YFW400TUH-05

FINISH: ANODIZED or PAINT

SCALE: NTS GLAZING: AS SHOWN

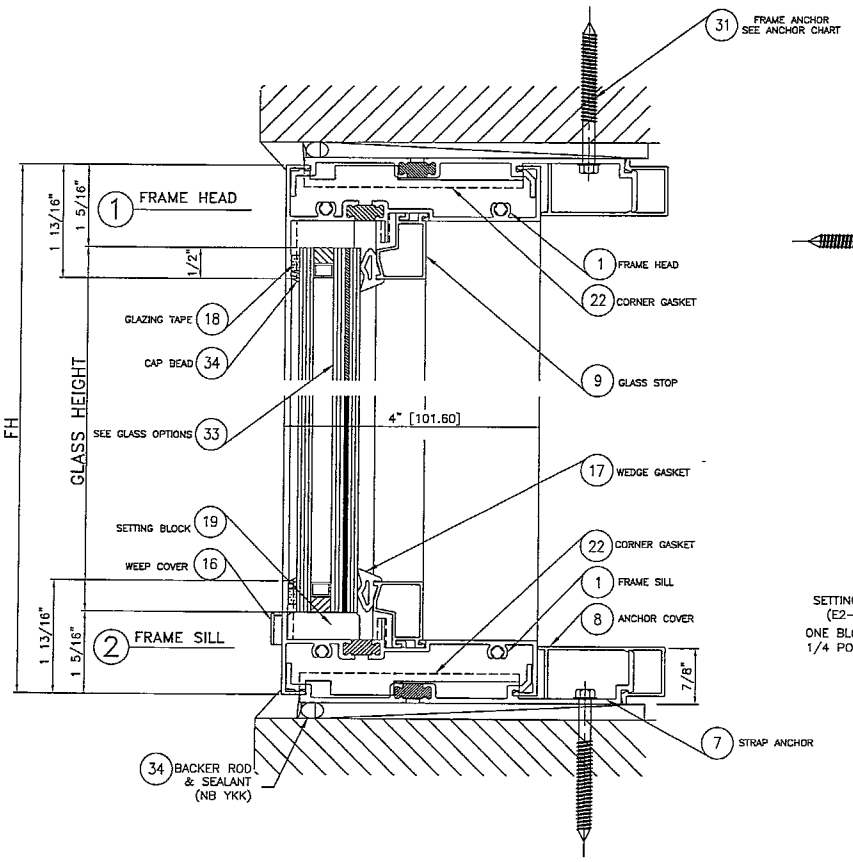
DRAWN BY: J.J.L. Rev.: 1

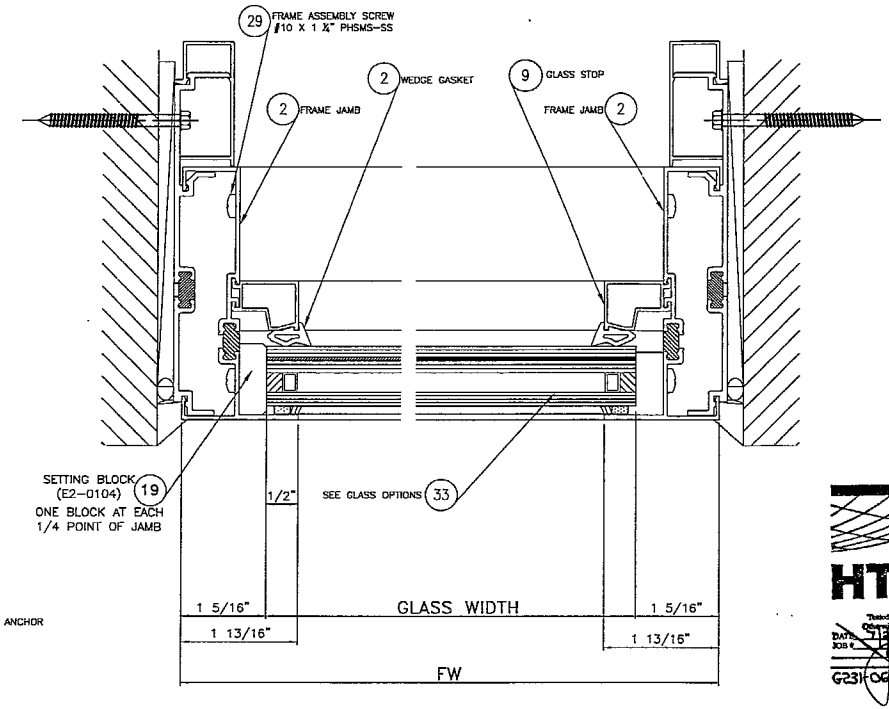
APPROVED BY: M.M. SHEET NO.: 5

DATE: 04/07/09

YFW400TUH FIXED WINDOW

FPA HVHZ / ASTM E-1996 AND DADE COUNTY, FL. SMALL MISSILE TESTING PROGRAM USING STRAP ANCHORS





3 LEFT JAMB

4 RIGHT JAMB

HTL
Tested Unless Otherwise Noted
DATE: 7/31/09
JOB #: G231-0603-09

YKK ap

YKK AP AMERICA INC.
HEADQUARTERS: 7680 The Bluffs, Suite 100 Austell, GA 30168 PH:(678)838-6000 FAX:(678)838-6056
DUBLIN PLANT: 332 Flowerlow Road Dublin, GA 31021 PH:(478)277-1965 FAX:(478)277-2500

NO.	REVISION	DATE	BY
1	ADD SPECIMEN YFW400TUH-03	4/17/09	JU

DESCRIPTION: CROSS SECTIONS YFW400TUH-03 FPA HVHZ / ASTM E-1996/ DADE COUNTY, FL. SMALL MISSILE TESTING PROGRAM

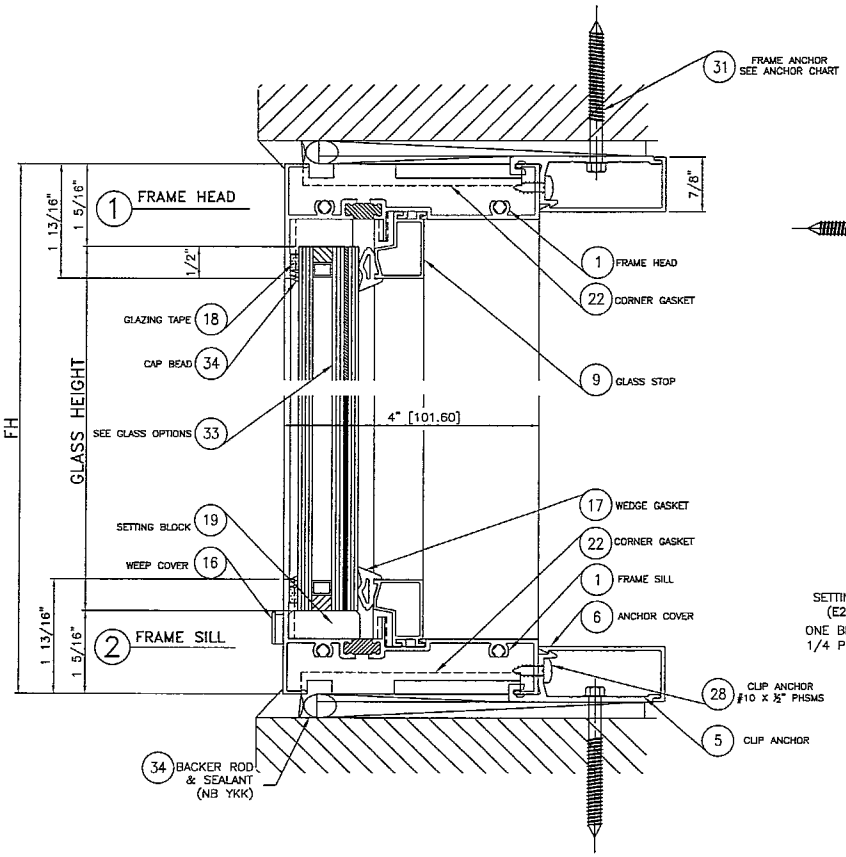
SYSTEM: YFW400TUH FIXED WINDOW SYSTEM

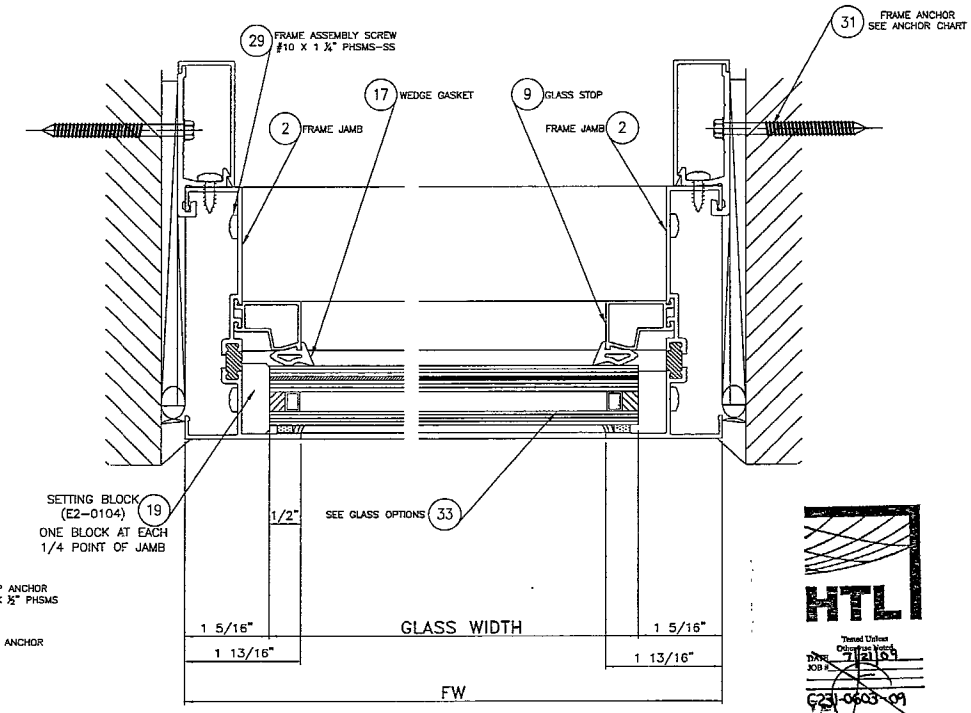
DRAWING NUMBER: YFW400TUH-06
FINISH: ANODIZED or PAINTED
SCALE: 1/2
GLAZING: AS SHOWN
DRAWN BY: J.U.
Rev.: 1
APPROVED BY: M.M.
SHEET NO.: 6
DATE: 04/07/09

F:\AUTODESK\LIBRARY\WINDOWS\YFW400TUH\CAD\DRAWINGS\IMPACT\YFW400TUH-06.DWG

YFW400TUH FIXED WINDOW

FPA HVHZ / ASTM E-1996 AND DADE COUNTY, FL. SMALL MISSILE TESTING PROGRAM USING CLIP ANCHORS





3 LEFT JAMB

4 RIGHT JAMB

HTL
Tested Unless Otherwise Noted
DATE 7/21/09
JOB # G231-0603-09

YKK AP AMERICA INC.
HEADQUARTERS: 7800 The Blvd., Suite 100, Augusta, GA 30168, PH:(678)838-6000, FAX:(678)838-6056
DUBLIN PLANT: 332 Flrelower Road, Dublin, GA 31021, PH:(478)277-1955, FAX:(478)277-2500

NO.	REVISION	DATE	BY
1	ADD REFERENCE YFW400TUH-07	4/17/09	JJD

DESCRIPTION: CROSS SECTIONS YFW400TUH-07 FPA HVHZ / ASTM E-1996/ DADE COUNTY, FL. SMALL MISSILE TESTING PROGRAM

SYSTEM: YFW400TUH FIXED WINDOW SYSTEM

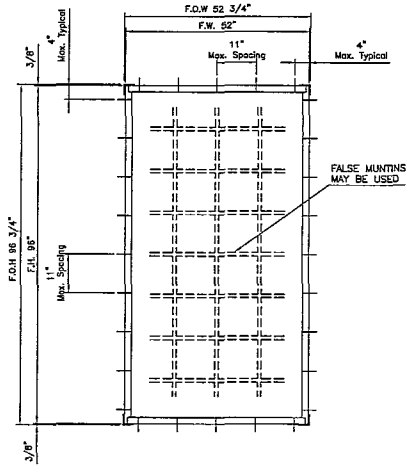
DRAWING NUMBER: YFW400TUH-07

FINISH: ANODIZED or PAINTED

SCALE:	GLAZING:
1/2	AS SHOWN
DRAWN BY:	Rev.:
J.J.D.	1
APPROVED BY:	SHEET NO.:
M.M.	7
DATE:	
04/07/09	

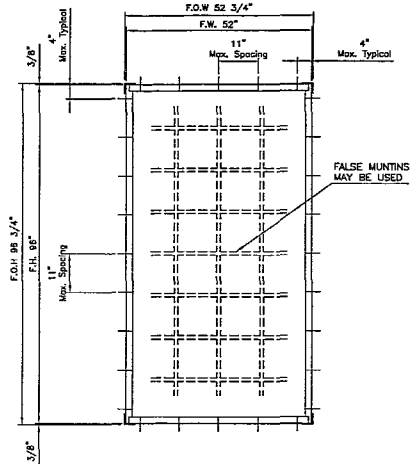
YFW400TUH FIXED WINDOW

FPA HVHZ / ASTM E-1996 and DADE COUNTY, FL. SMALL MISSILE TESTING PROGRAM



SPECIMEN YFW400TH-03

STRAP ANCHORED TO 2x WOOD BUCK, USING #14 FASTENERS



SPECIMEN YFW400TH-04

CLIP ANCHORED TO 2x WOOD BUCK, USING #14 FASTENERS

CONSTRUCTION

FRAME CORNER

COPED, SECURED WITH TWO (2) NO. 10 X 1 ¼" SMSSS PER CORNER AND SEALED WITH A RUBBER GASKET BETWEEN HORIZONTAL AND VERTICAL FRAME MEMBERS. ALL VOIDS AND RECESSED JOINTS SHALL BE SEALED WITH TREMCO 600 SEALANT OR EQUAL

SUBSTRATE REQUIREMENTS:

WOOD: MIN. 2x GRADE 2 SOUTHERN PINE
METAL STUD: MIN. 18 GA. 33 KSI STEEL
STRUCTURAL STEEL: MIN. 12 GA. 36 KSI
CMU: MIN. 1800 PSI
CONCRETE: MIN. 2500 PSI

HTL
Tested Unless Otherwise Noted
DATE: 7/31/09
JOB #: G231-0603-09

YKK AP

YKK AP AMERICA INC.
HEADQUARTERS: 7680 The Bluffs, Suite 100 Austell, GA 30168 PH:(678)838-8000 FAX:(678)838-8068
DUBLIN PLANT: 332 Firetower Road Dublin, GA 31021 PH:(478)277-1935 FAX:(478)277-2500

NO.	REVISION	DATE	BY
1	ADD SPECIMEN YFW400TH-05	4/17/09	JU

DESCRIPTION: FRAME ANCHORING ELEVATIONS FPA HVHZ / ASTM E-1996/ DADE COUNTY, FL. SMALL MISSILE TESTING PROGRAM

SYSTEM: YFW400TUH FIXED WINDOW SYSTEM

DRAWING NUMBER: YFW400TUH-08
FINISH: ANODIZED or PAINTED
SCALE: NTS
GLAZING: AS SHOWN
DRAWN BY: J.U.
Rev.: 1
APPROVED BY: M.M.
SHEET NO.: 8
DATE: 04/07/08

P:\AUTOCAD\LIBRARY\WINDOWS\YFW400TUH\DRAWINGS\SUBJECT\YFW400TUH-08.DWG

CERTIFICATE of COMPLIANCE

OVERALL RATING	
U-Factor: (Btu/h•ft²•°F)	
SHGC:	

Directions: Fill out form completely. Determine the Overall Rating for this project by using the C.O.G. U-Factor and C.O.G. SHGC from Table 1 and looking up the overall rating from Table 2. Indicate the Overall Rating in the space above. Linear interpolation is permitted.

Certificate Authorization

Name: Company:

Signature: Date:

CERTIFIES THAT THE MATERIALS LISTED ON THIS CERTIFICATE WERE INSTALLED ON THE PROJECT IDENTIFIED BELOW.

PROJECT INFORMATION:

Street Address:

City: State: Zip:

GLAZING CONTRACTOR / INSTALLER: Contact Person:

Street Address: Phone Number:

City: State: Zip:

TABLE 1 – GLAZING

GLAZING MATERIAL SUPPLIER: Contact Person:

Street Address: Phone Number:

City: State: Zip:

Glass and Spacer Type:

Center-of-glass (C.O.G.) U-factor: Btu/h•ft²•°F Center-of-glass (C.O.G.) SHGC:

TABLE 2 – FRAMING

FRAMING MATERIAL SUPPLIER: Contact Person:

YKK AP America Inc. David Warden

Street Address: Phone Number:

270 Riverside Parkway, Suite A 800-955-9551

City: State: Zip:

Austell GA 30168

U-factor Matrix (Btu/h•ft²•°F)		SHGC Matrix	
C.O.G. U-factor	OVERALL U-factor	C.O.G. SHGC	OVERALL SHGC
0.48	**0.56**	0.75	**0.65**
0.46	**0.55**	0.70	**0.61**
0.44	**0.53**	0.65	**0.57**
0.42	**0.52**	0.60	**0.52**
0.40	**0.50**	0.55	**0.48**
0.38	**0.48**	0.50	**0.44**
0.36	**0.47**	0.45	**0.40**
0.34	**0.45**	0.40	**0.35**
0.32	**0.44**	0.35	**0.31**
0.30	**0.42**	0.30	**0.27**
0.28	**0.41**	0.25	**0.23**
0.26	**0.39**	0.20	**0.18**
0.24	**0.37**	0.15	**0.14**
0.22	**0.36**	0.10	**0.10**
0.20	**0.34**	0.05	**0.05**

Product Line:

YFW 400 TU/TUH

The overall ratings for U-factor and SHGC are based on a size of

1200 mm x 1500 mm(47 1/4 in x 59 1/16 in) as required in NFRC 100.

Overall U-factors and Solar Heat Gain Coefficients (SHGC) listed in the matrix were determined in accordance with NFRC 100 and NFRC 200 respectively by a NFRC accredited laboratory.

ACCREDITED LABORATORY:

Architectural Testing

Reference Test Report #:

90981.01-116-45

CSI MASTERFORMAT SECTION NUMBER **08 51 13**
CSI MASTERFORMAT SECTION TITLE **ALUMINUM WINDOWS**
YKK AP PRODUCT SERIES **YKK AP YFW 400 TUH FIXED WINDOWS**

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Furnish and install YKK AP Architectural Aluminum Windows, complete with hardware and accessories as shown on shop drawings and specified in this section.
   1. YKK AP Series YFW 400 TUH Aluminum ThermaBond Plus® Impact Resistant Fixed Windows.

B. Related Sections:
   1. Sealants: Structural silicone sealant.
   2. Glass and Glazing:
      a. Units shall be factory or shop glazed.
   3. Single Source Requirement: All products listed below shall be by the same manufacturer.
      a. Section 08 32 13 Sliding Aluminum-Framed Glass Doors.
      b. Section 08 41 13 Aluminum-Framed Entrances & Storefronts.
      c. Section 08 44 13 Glazed Aluminum Curtain Wall.
      d. Section 08 44 33 Sloped Glazing Assemblies.

1.02 TEST AND PERFORMANCE REQUIREMENTS

A. Performance Requirements: Windows shall comply with the following specific performance requirements indicated.
   1. Air Infiltration: Completed window systems shall have 0.30 CFM/FT² (16.5 m³/h·m²) maximum allowable infiltration when tested in accordance with ASTM E 283 and TAS 202 at a differential static pressure of 6.24 psf (299 Pa).
   2. Water Infiltration: There shall be no uncontrolled water leakage when tested in accordance with ASTM E 331 and TAS 202 at a static pressure of 15 psf (719 Pa).
   3. Static Load: There shall be no damage to fasteners, hardware, accessories, or any other damage that would render the window inoperable when tested in accordance with ASTM E 330 and TAS 202 at a differential static pressure of 90.0 psf positive and 120.0 psf negative.
   4. Large & Small Missile Impact: There shall be no signs of penetration, rupture, or opening after the impact test when tested in accordance with ASTM E 1886/1996 and TAS 201.
   5. Cyclic Load: Test to be done upon completion of missile impact test. There shall be no damage to fasteners, Hardware, accessories, or any other damage that would render the window inoperable when tested in accordance with ASTM E 1886/1996 and TAS 203.
   6. Thermal Performance: When tested in accordance with AAMA 1503 and NFRC 102:
      a. Condensation Resistance Factor (CRF_f): A minimum of 67.
      b. Thermal Transmittance U Value: 0.40 BTU/HR/FT²/ºF or less.
   7. Acoustical Performance: Acoustical Performance: When tested in accordance with ASTM E 90:
      a. Sound Transmission Class (STC) shall not be less than 38.
      b. Outdoor–Indoor Transmission Class (OITC) shall not be less than 30.
   8. Forced Entry Resistance: Windows shall be tested in accordance with ASTM F 842 and TAS 202 and meet the requirements of performance grade 10.

Note: Performance based on lab testing and will vary by configuration and glass type; contact YKK AP engineering for job specific analysis at higher performance levels. **[**Acoustic performance achieved with 1" IG unit consisting of 1/4" heat strengthened exterior glass, 3/8" air space, and 3/8" laminated interior glass, at a temperature of 75º. **??]**

1.03 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."

B. Quality Assurance/Control Submittals:
   1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.

C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
   2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.

B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, and workmanship standard.
   1. Mock-Up Size:
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.05 PROJECT CONDITIONS / SITE CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.06 WARRANTY

A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.
   1. Warranty Period: Manufacturer's one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.

EDITOR NOTE: Longer warranty periods are available at additional cost.

PART 2 PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

A. Acceptable Manufacturers: YKK AP America Inc.
   270 Riverside Parkway, Suite 100
   Austell, GA 30168
   Telephone: (678) 838-6000; Fax: (404) 838-6001
   1. Operable Windows: YKK AP YFW 400 TUH ThermaBond Plus® Impact Resistant Fixed Windows.

B. Windows:
   1. AAMA Designation: AW-PG100-FW.
   2. Description: The windows shall be extruded aluminum; 4" frame depth; Horizontal frame members run through notched vertical members, butted and mechanically fastened with two stainless steel screws per joint; Factory assembled.
   3. Configuration: The windows shall be Fixed, Fixed by Fixed*, or Fixed over Fixed*.
   4. Glazing (Contact YKK AP for approved glass types):
      a. Large Missile Impact: Exterior glazing tape with silicone cap bead; 1" (overall) insulating units; Interior EPDM (silicone compatible) spacer with structural silicone sealant; Removable, extruded aluminum interior glazing bead; Factory glazed.
      b. Small Missile Impact: Exterior glazing tape with silicone cap bead; 1" (overall) insulating units; Interior EPDM (silicone compatible) spacer with structural silicone sealant; Removable, extruded aluminum interior glazing bead; Factory glazed.
   5. Thermal Barrier: Provide continuous thermal barrier by means of a poured and debridged pocket consisting of a two-part, chemically curing high density polyurethane which is bonded to the aluminum by YKK ThermaBond Plus®. Systems employing nonstructural type thermal barriers are not acceptable.

*NOTE: Currently approved for blast mitigation only.

2.02 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.
   1. All members shall have minimum wall thickness sufficient to meet the specified structural requirements.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:
   1. Fasteners: All fasteners shall be AISI 300 series (except for self-drilling, which are to be series 400) stainless steel.
   2. Weather-stripping: All weather-stripping shall be Fin-Seal or equivalent.
   3. Glazing Materials: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; glazing gaskets in accordance with ASTM C 864.
   4. Glazing Adhesive: Structural silicone sealant.

2.04 RELATED MATERIALS (Specified In Other Sections)

A. Glass: All windows shall be factory glazed in accordance with manufacturer's standards.
   1. Insulated glass type and thickness shall be in accordance with manufacturer's recommendations for design pressure.

2.05 FABRICATION

A. Frame:
   1. Horizontal frame members run through notched vertical members, butted and mechanically fastened with two screws per joint into integral screw splines; Meeting rail notched at each end, butted and mechanically fastened with two screws per end into integral screw splines.
   2. All framing joints shall be sealed with quality grade sealant meeting AAMA 803.3 to ensure water tight joint.

B. Exterior Panning & Trim:
   1. Exterior panning & trim shall be extruded aluminum of profile and dimensions as detailed on approved shop drawings.
   2. All joints shall be sealed with quality grade sealant meeting AAMA 803.3 to ensure water tight joint.

C. Mullions:
   1. Mullions shall be of extruded aluminum of profile and dimensions as detailed on approved shop drawings.
   2. Mullions must provide adequate structural properties to resist wind pressure as specified herein.

2.06 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE	DESCRIPTION
YS1N*	Clear Anodized Plus®
YH3N	Champagne Anodized Plus®
YB1N	Medium Bronze Anodized Plus®
YB5N*	Dark Bronze Anodized Plus®
YK1N*	Black Anodized Plus®
YW3N	White Anodized Plus®
M	Mill Finish

   * Indicates standard finish usually carried as inventory.
   Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability (See AAMA 612).

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:
   1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612-02. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
      a. Exposed Surfaces shall be free of scratches and other serious blemishes.
      b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
      c. The anodized coating shall comply with all of the requirements of AAMA 612-02: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
      d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. High Performance Organic Coating Finish:
   1. Fluoropolymer Type: Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP

procedures and meeting AAMA 2605 specifications.
2. Colors: Selected by Architect from the following:
   a. Standard coating color charts.
   b. Custom coating color charts.
   c. Color Name and Number:

D. Finishes Testing:
1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.
2. Submit samples with test area noted on each sample.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS/RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest installation instructions are available at www.ykkap.com.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials.
2. Shim and brace aluminum system before anchoring to structure.
3. Completed windows must allow water to be wept to the exterior; Verify weep holes are open and weep caps are installed correctly.
4. Seal metal to metal window system joints using sealant recommended by system manufacturer.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Field Test: Conduct field test to determine watertightness of window system. Conduct test in accordance with AAMA 502-02 at locations selected by Architect.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust operating items as recommended by manufacturer.

B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance, and remove construction debris from project site. Legally dispose of debris.

C. Protection: The General Contractor shall protect installed product's finish surfaces from damage during construction.

END OF SECTION

Document Number 05-3013-03

This document supersedes all previous versions.